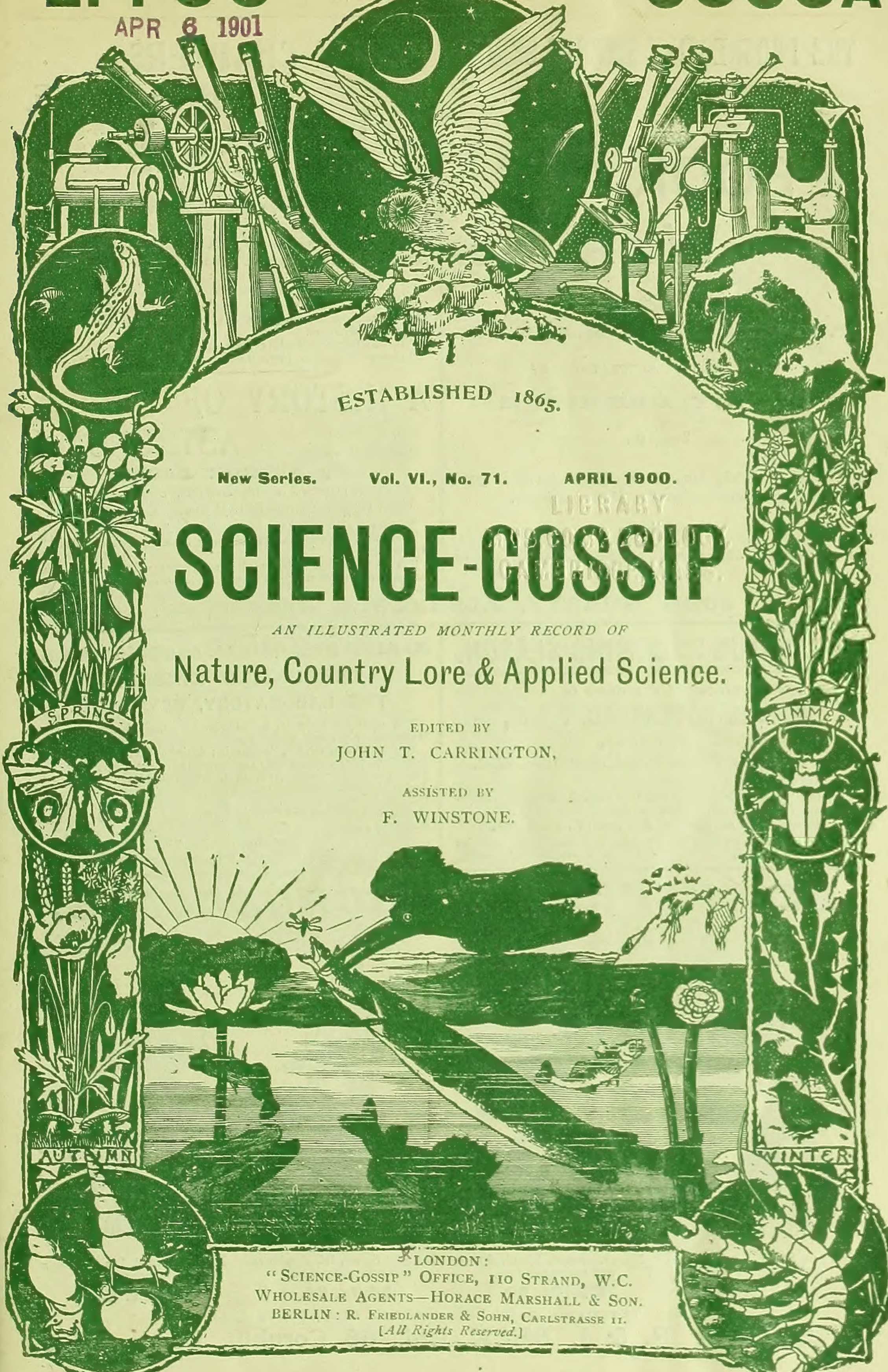

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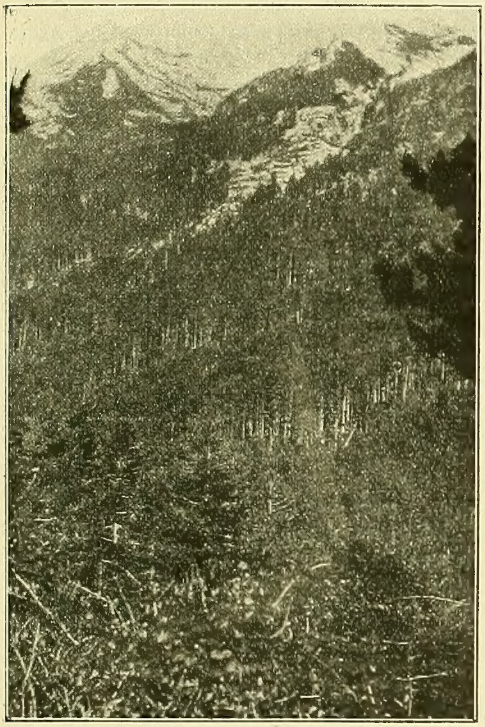
BUTTERFLY-COLLECTING IN CORSICA.

By the Rev. H. C. Lang, M.D.

After having had some successful weeks of butterfly-collecting at Digne, St. Martin Vesubie, and other places in the South of France, and finding myself at Nice, I determined to visit Corsica. Having succeeded with *Papilio alexanor* at Digne, I thought I might as well try to take *P. hospiton* also. Corsica had always been to my imagination a sort of

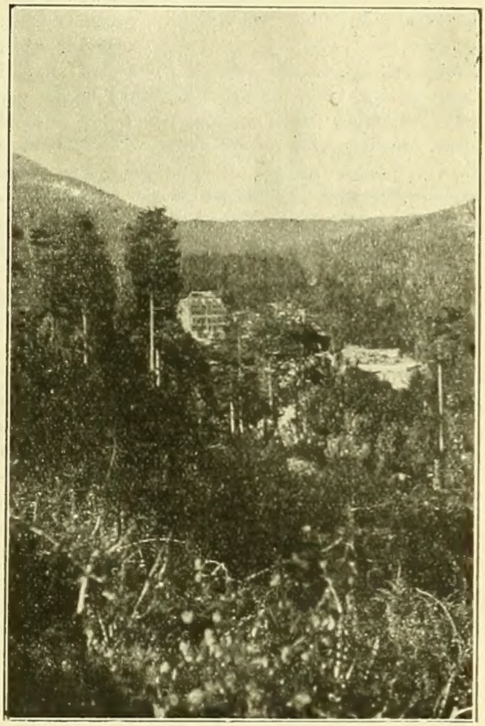


From Photo] [*by Dr. Lang.*

Forest of Vizzavona.

enchanted island, with a certain air of mystery hanging over it apart from brigands and vendettas and things of that kind. I knew there were certain butterflies which one could only see there alive, unless one chose to go further on to Sardinia. So I started from Nice in the very best of spirits on Saturday evening, the 8th of last July. The trip on board the little steamer of the Fraissinet Line was most delightful, as much as a summer night on the Mediterranean could make it. When we anchored off Calvi at 4 A.M., and the sun in rising began to light up the mountains in the centre of the island, I felt that my eyes were resting on a fairer scene than had ever before delighted them.

Going ashore in a small boat, I had to wait at Calvi some two hours before my train started for Vizzavona, which place I had selected as my destination. I had ample opportunity of admiring the effect of the increasing light upon the marvellous scene of land and sea; but closer attention revealed the fact that vegetation was much dried up on the coast, and there was very little to be seen in the way of verdure, except some thick bushes climbing up the rock on which the citadel is built. My "Gerz" glass resolved these into dense masses of the prickly pear cactus, which seems to grow everywhere round the coast, and is used for making hedges and fences. Very striking was the strong aroma that literally filled



From Photo.] [*by Dr. Lang.*

Grand Hôtel de Vizzavona.

the air. This I had noticed on board some miles away from land, just as one smells the scent of gorse when off the Cornish coast at a distance out at sea. On this occasion I could certainly smell Corsica long before it could be seen. The fascinating and powerful scent is caused chiefly by an aromatic plant, *Helichrysum angustifolium*, which clothes the "Makis"

and extends up into the forest region. Myrtle, bay, mountain pines, and thyme are also probable components of this natural incense.

A railway runs right through the island, and carries with it its civilising power. There are no brigands in Corsica now, though it is said one or two ex-members of that profession are still to be interviewed by the curious in such people or by students of criminology. The train moves very slowly; but who would wish it to be faster that sees Corsica for the first time on a July morning? For a period the route is near the coast; and the glimpses of quaint towns with cupola-topped church towers, of rocky headlands jutting out into the sparkling sea, make one forget the time that is passing and the heat that is increasing as the sun mounts up towards noontide. Soon we get on to the "Makis," the wilderness that lies between the sea and the forest zone, sloping gradually upwards. It is as wild as Dartmoor, but softened with the balmy breath of southern breezes; and luxuriant are the plants already alluded to, with many others. Here and there we passed a road whose milestones reminded one that we are in a department of France. Once there was seen a cyclist, to show that Corsica is up to date. On we went, slowly but pleasantly upwards, until we reached Corte, on the verge of the forests and backed by lofty mountains. It is a strongly built and fortified place, bristling with romantic episodes in the former days of Corsica's history. After passing this town the scenery increased in grandeur as we continued upwards through rocky gorges and steep mountain slopes covered with magnificent pine forests. We reached the sub-Alpine pine zone at Vivario, and by the time the train stopped at Vizzavona were in the very heart of the best entomological collecting-ground, and in almost the exact centre of the island.

Vizzavona itself consists of a few scattered peasants' cottages, a railway station, and a large hotel, "The Grand Hôtel de Vizzavona." This building looks strangely out of place, and one is at first inclined to view its presence with feelings of the deepest resentment; but a further acquaintance with its convenience and comfort compels an alteration of opinion. It is in the forest of Vizzavona, on the upper verge of the pine region, consequently much better situated for butterfly-collecting than the less pretentious and more picturesque "Hôtel de Monte d'Oro," which is higher up the road to Ajaccio. On the right-hand side going up the pass is Monte d'Oro, about 8,000 ft. high, and on the left Monte Renoso, about the same altitude. Vizzavona itself is at an elevation of 4,000 ft., consequently with a climate much cooler than that of the coast or the "Makis." Above the pine zone there is an extensive forest of beech-trees, such as one sees on the hills in Buckinghamshire, and above this rocky slopes leading up to the mountain summits; but these are not the best regions for butterflies. The mountain lepidoptera of Corsica are sub-Alpine, and no Alpine forms occur. There are no Parnassii, Erebiae, Alpine Argynnides, Coliades, or Lycaenids, such as one would certainly meet with on the mainland at elevations equal to that of these mountains.

The best collecting-ground is on the descent from Vizzavona to Tattone, and on this route most, if not all, of the special Corsican forms of butterflies may be met with. Judging from the "sugar" marks on the tree-trunks by the roadside, this is also a good locality for moths. These special forms of butterflies, some of them peculiar to Corsica and Sardinia, are *Papilio hospiton*, *Anthocharis tagis* var. *insularis*, *Vanessa ichnusa*, *Argynnis elisa*, *Satyrus neomiris*, *S. semele* var. *aristaeus*, *Pararge tigelius*, *Coenonympha corinna*, and *Syrichthus sao* var. *therapne*. On arriving at Vizzavona, at about 2 P.M., I almost at once started out to look for butterflies, the afternoon being bright and sunny. Just outside the hotel *Coenonympha corinna* was in great abundance; but whilst I was busy with these, there came on a very heavy thunderstorm with drenching rain which compelled me to seek shelter. The rain lasted for the rest of the afternoon and evening. The next day being fine with a cloudless sky, the following species were observed: *Papilio machaon* var. *aurantiaca*, *Pieris brassicae*, *P. rapae*, *L. sinapis*, *C. hyale*, *C. edusa*, *Polyommatus phleas* (with a dark form approaching var. *eleus*) on *Helichrysum* at Tattone. *Lycaena aegon* is a small dark form at Vizzavona, *L. icarus* has there an underside much resembling that of *L. zephyrus*, but with intra-discoidal spots on fore-wings. *L. argiolus* is common at Vizzavona by the roadside, with underside nearly white and with very small spots. This was chiefly found flying round bramble bushes. *L. argus* was also taken.

Whilst referring to the roadside I may mention that on the road between Vizzavona and Tattone nearly all the butterflies that are found in Corsica may be taken; and we can strike right and left into the pine woods at the foot of Monte Renoso on the one side, and Monte d'Oro on the other. It is in this district that *Papilio hospiton* can be taken at the proper time, though I, being too late for it, did not see any. For the opposite reason, because too early, I did not see any *Vanessa ichnusa*, which appears about July 20th. The Vanessae I found were *V. c-album*, *V. egea*, *V. io*, *V. atalanta*, and *V. cardui*. Fritillaries were tolerably common, the species being *Argynnis pandora* (a fine fresh specimen of which I took in the hotel garden at 8 A.M.), *Argynnis paphia* var. *anargyra*, and *A. elisa*, which may be taken commonly in open places in the pine woods when the sun is out. It is very conspicuous on account of the small size of the black spots on the bright fulvous wings. Among the Satyridae I saw no species of *Melanargia* nor of *Erebia*. *Satyrus semele* is represented by the var. *aristaeus*, which was not uncommon. The only other *Satyrus* was *S. neomiris*, a pretty insect which is very abundant at Vizzavona. I believe it is quite distinct, and not an insular form of any other species. *Pararge egeria* in the usual southern form was not uncommon; *P. megera* var. *tigelius* was common at Tattone and at Bastia, where

I also found *Epinephele tithonus*, and more frequently *E. ida*. *E. janira* occurs commonly in its var. *hispulla*, which does not differ from that form found in the South of France.

Coenonympha corinna was the commonest butterfly at Vizzavona, a very pretty and distinct little Satyrid. It was to be seen everywhere and in great numbers. *C. pamphilus*, though found there, is not nearly so common; I did not take the var. *lyllus*. I found no Hesperidae during my stay in Corsica, though I sought diligently for *Syricthus therapne*, which I had hoped to find.

On Friday, July 14th, I began my return, going by train to Bastia, which I reached at noon. There it was intensely hot, but very enjoyable. The old town, with its picturesque church and buildings mingled with southern vegetation and sloping down to the blue Mediterranean, formed a picture worthy of Ruskin's words or Stanfield's brush. After lunch I braved the fierce heat, and went collecting in some orchards on the hillsides behind the town. My takings were principally Satyridae, including *Satyrus aristaeus*, *S. tithonus*, *S. ida*, and *S. tigelius*. Everything was so dried up that it was difficult to find a verdant spot, so I had to trespass on private grounds. No one interfered; probably my net was a sign that I was like the man in "The Runaway Girl" "searching for the rarer lepidoptera," and so I was left alone. This evening Bastia was *en fête*; and such a *fête*!—a "festa duplex major," as ecclesiastical language would express it. So we left the harbour, on board the steamer, amid the firing of guns from the citadel, fireworks, and illuminations—for it was the "Fête Nationale." One was glad, in spite of the vivacity of the scene, to get out into the stillness of night upon the sea, and steam back to Nice in peace and quietness.

Though *Papilio hospiton* was not in my collecting-box, I had a fair collection of Corsican butterflies—made during my five days' visit—and, more than that, I had seen and also scented this wonderful island. I left Corsica with the hope of some day paying it another visit.

All Saints' Vicarage, Southend-on-Sea:
March 3rd, 1900.

REARING SNAILS IN CAPTIVITY.

By Eleonora Armitage.

THE remarks on homing of snails and other matters connected with the living animal in Science-Gossip (*ante*, p. 243) have interested me, and I feel tempted to transcribe some of my notes and observations on the subject. I am not a collector of shells nor a student of conchology, neither do I possess any literature on the subject; therefore anything I can say is only a record of my own observations.

In the summer of 1895 I was given two individuals of the "Roman" or "apple" snail (*Helix pomatia*), which is not found in this neighbourhood. I kept them under a large bell-glass in a shady part of the garden, sometimes on turf and sometimes on a flower-border, where they could burrow at their ease and keep themselves moist and cool. I fed them on cabbage and lettuce leaves, with a strawberry now and then. Occasionally they were allowed to take exercise, being tethered to a stake on the grass by means of a long piece of fine string, one end of which was tied round the shell. It was interesting to watch them crawl to the end of their tether and strain to get beyond, pulling more than I ever saw before of a living snail's body out of its shell. They spent most of the daytime sleeping, nestled in the grass or under the shade of a cabbage leaf, awakening in the evening to crawl over the interior of the bell-glass and to feed, which they did mostly at night. Often they roosted on the glass. I had to keep them prisoners, as I did not want them to devour my choicest flowers, which is what snails and slugs always do; but I have known them escape, probably by burrowing beneath the bell-glass and eventually emerging on the other side. I have frequently recaptured them; they do not stray very far, and are conspicuous by their size and the light tints of the shell and the pale colour of the foot. They did not display any homing instinct; I have never known one to return to the bell-glass or its neighbourhood. Both these individuals in July burrowed about two to three inches in the soil and deposited eggs. The egg is white, round, glistening, and opaque, and about the size of a garden pea. Unfortunately none of these eggs hatched out; the weather was very hot, and probably some dried up and some were devoured by slugs and insects.

Towards the end of October they retired underground, and when I dug them up a few days after I found that they each had made a very neat, smooth, white porcelain door to the mouth of the shell and gone to sleep for the winter. They were safely re-interred about three inches below ground.

The larger of the two snails weighed one ounce, its diameter was $1\frac{3}{4}$ in. × $1\frac{1}{2}$ in., girth 5 in. × $4\frac{1}{2}$ in.; the smaller one weighed $\frac{3}{4}$ ounce, diameter $1\frac{1}{2}$ in. × $1\frac{1}{4}$ in.; girth $4\frac{1}{4}$ in. × $3\frac{3}{4}$ in.

In the spring of 1896 the larger snail emerged on April 24th, while the smaller one did not appear till May 23rd. During the summer the larger snail laid a batch of eggs and the smaller one two batches. Early in July the larger snail died. I was determined, if possible, to rear some young snails; so I put some damp moss in a biscuit tin, and placed the

eggs among it, and some young dandelion plants to act as food for the baby snails on emerging. Of course the lid was kept on the tin, with air-holes punched in it. After four or five weeks the little snails hatched out at the end of July. They were tiny white transparent things, but lively and hungry. They settled down to dandelion diet at once. After feeding, the greenstuff could plainly be seen in the alimentary canal. In two months they had about doubled in size, and were getting some pigment on the shell, which was extremely delicate and brittle. In the autumn they, too, made doors to their shells and went to sleep; and the tin containing them was buried in the ground.

At the beginning of April 1897 they were dug up, and I found that most of them were already awake and beginning to feed. They were now about $\frac{3}{8}$ in. in diameter, and grew during this summer to about $\frac{7}{8}$ in., but varied slightly both in size and colouring.

On March 17th, 1898, two of the young ones awoke and appeared above ground; this was rather an early date. They grew considerably during that summer. In 1899 I had one original snail and a dozen young ones. The latter grew as large as the old one; and now that they have hibernated I cannot distinguish that one from the others, but I believe it to be alive still.

None of the young ones have laid eggs as far as I know, and they are now three and a half years old; therefore the old one, which was full grown when I had it in 1895, should be now at least eight years old. I have often asked, and have never been able to obtain, the information as to how long is the lifetime of a snail; but some one once suggested two years. To obtain an answer was one of the reasons why I took to keeping snails. I weighed and measured these snails after they had hibernated, the differences between them being small. The average is:—Weight, $\frac{5}{8}$ oz.; size, length $1\frac{5}{8}$ in., width $1\frac{3}{8}$ in.; height, $1\frac{1}{8}$ in. I expect they will grow larger next year.

The Roman snails have not developed any tameness in captivity, but continue to draw in their horns and bodies at the approach of a human being. Snails can, however, be interesting pets and become quite tame. In May, 1896, I obtained four specimens in Barbados, W.I., of a very large handsome land snail, *Bulimus* (*Borus*) *oblongus*, and brought them back to England in June. I could not bring their own food for the voyage, but they fed on lettuces supplied by the steward. They lived in a large biscuit tin, and took exercise on deck in fine weather and on the saloon tables when it was cold. When they reached their home they were put under a large bell-glass in a shady spot. They did not care for cabbage, but would eat lettuce and preferred dandelion leaves to anything else. They liked burrowing in the moist earth. They have a handsome long conical shell, self-coloured pink with a dark border; the body is a very dark slaty-black colour, with a broad blunt head, fringed lips, and a large mouth-opening. The following measurements will give an idea of the size of these fine molluscs. No. 1: length of shell, $3\frac{3}{4}$ in.; length of foot, $5\frac{1}{2}$ in.; weight, 4 oz.; No. 2: shell, $3\frac{3}{4}$ in.; foot, 5 in.; weight, $4\frac{1}{2}$ oz. They looked very fine, crawling about in a dignified manner, five inches of dark foot carrying the large pink shell.

Fearing the rigours of an English winter for tropical snails, I sent them to the kind care of the Superintendent of the Zoological Gardens, London, where they spent the winter in a glass box in the Insect House, eating lettuces. Three of the four survived to return to me at the end of May in the following year. They fed well, and crawled about and burrowed as usual; but after the middle of July they faltered, and one after the other died in a few weeks, first ceasing to feed and becoming almost inactive. I could not discover the cause of death, but they may have reached the limit of their existence. They did not breed in England. I found it was quite unnecessary to tether these snails, as they had a strong homing instinct. I took them out daily from the bell-glass, and put them some little distance away on a piece of turf, where they liked crawling about and feeding; and after they had had enough of it they always turned homewards, and went back to the bell-glass. Here they used often to begin burrowing in the soil just outside the glass, so as to get back inside. I have found them in various stages—some partly, and some quite, underground. They used to meet the Roman snails occasionally, and even crawl over each other, but they never showed any inclination for acquaintanceship. They were not at all afraid of me, and did not shut up in their shells when I took them up; but they liked to sit on the back of my hand. I think they enjoyed the warmth, and they always came fully out of the shell; then I would give the snail a tender young dandelion leaf, poking the apex of it to the mouth, which at once opened and closed on it. I held the other end, and in a marvellously short time the whole leaf would disappear down to the stalk; while the chewing of the tooth-ribbon made quite a loud rasping noise. The mouth was so wide that a small leaf could enter flat. I much regretted the loss of these interesting pets.

Dadnor, Ross, Herefordshire:
January 1900.

The Common Bittern.—This rare and interesting bird has been recorded from several parts of both England and Ireland during the past winter. A specimen was taken in a ditch recently by a boy near Rillington, in East Yorkshire. It has since been kept alive and has much improved in health and weight, being very thin when captured. Though now so rare in Britain, this species bears the English specific name of "common," which has been retained to distinguish it from the little bittern. It is many years since it was really abundant in our marshlands. Its scientific name is *Botaurus stellaris*; and its local name was "butter-bump," doubtless from its peculiar booming note. Most years there are visitors of this species from the Continent, probably from Holland, where it still occurs commonly.

DESMIDS.

By Dr. G. H. Bryan, F.R.S.

(*Continued from page* 259.)

Transferring to Glycerine.—Desmids cannot be transferred directly from water into glycerine, as the sudden change of density would cause the cells to contract and utterly destroy the form and arrangement of the endochrome. There are two methods of effecting the transference sufficiently gradually to avoid damaging the specimens, the first by evaporation from a dilute solution containing glycerine, the second by osmosis, the glycerine gradually percolating through a thin membrane, and finding its way to the desmids. The method usually recommended and described as Hautsch's method consists in transferring the desmids to a mixture of 3 parts alcohol, 2 parts water, and 1 part glycerine, and leaving the mixture freely exposed to the air, but protected from dust till the alcohol and part of the water has evaporated. If methylated spirit be used for the alcohol, a cloudy opaque mixture will be obtained, which is difficult to clarify either by filtration or by leaving for weeks to settle, and then siphoning the clear liquid from beneath the impurities which float on its surface. This difficulty could, of course, be prevented by the lavish use of pure alcohol in place of methylated spirit, but seeing that 3 parts of alcohol have to be evaporated for every 1 part of glycerine retained, the method involves a rather extravagant consumption of pure spirit, and a pint will not go far when a quantity of material, including a number of different gatherings, has to be dealt with. Moreover the evaporation is a slow process, as after the alcohol has evaporated it is necessary to evaporate a considerable portion of the water as well; especially if, as usually happens, a quantity of extra water is introduced with the desmids. And the conditions "freely exposed to the air, but protected from dust," are somewhat incompatible.

Some desmids, too, notably certain members of the genus *Closterium*, have a most annoying habit, at the least provocation, of floating on the surface of the fluid. This difficulty occurs in the processes of fixing and cleaning, where it can be obviated by a little care; but the addition of Hautsch's mixture to the water containing the desmids produces violent circulating currents in the liquid, by which a large proportion of the desmids are carried to the surface. Once on the surface the preservative fluid never penetrates them properly, and many of the best contents of the gathering are lost. It would be desirabl to utilise this tendency to float in cleaning gatherings of desmids, if such a method should prove feasible, but the difficulty, once they have floated, is to g the desmids immersed again in the water.

Fig. 3. *Closterium striolatum.*

Fig. 4. *Clos*[illegible]

(From photographs by F. Noad Clark.)

Some American writers have recommended the evaporation of the glycerine from a 10 per cent. aqueous solution, a still more tedious process, which is open to the further objection that even the sudd transference of the desmids into 10 per cent. glyceri may give rise to some contraction of the specimens.

The second method was suggested to me by Mr. White, of Litcham, the beauty of whose slides is sufficient testimony to its advantages. The best plan

is to take a good cork, and through it cut a hole, say, $\frac{3}{8}$ to $\frac{5}{8}$ of an inch in diameter, and then cut it into slices, say, $\frac{1}{4}$ to $\frac{1}{2}$ of an inch in thickness. Procure a piece of toughened "parchment paper," such as is commonly used for packing tobacco, biscuits, or other articles, and fix a circular disc of the paper across the bottom of each slice of the perforated cork, attaching it with gold size, brown cement, shellac varnish, or any other suitable cement. In this way a number of little boxes are made, whose sides are of cork, but through whose bottoms diffusion of liquids can take place.

Take up the water containing the desmids with the pen-filler already mentioned, and place it in one of the little boxes. Then float the box in a jar of glycerine, which should be stoppered or covered with a tight-fitting cap. The water will gradually diffuse through the toughened paper into the glycerine, and the glycerine will diffuse, but more slowly, into the box. In the course of about forty-eight hours or more the water will be replaced by nearly pure glycerine; but, owing to the unequal rate of diffusion of the two liquids, the glycerine will stand at a lower level in the box than the water did originally. It is therefore advisable to place a fair quantity of water in the box to start with. When the transference of liquids has taken place, the glycerine containing the desmids may be taken up with the pen-filler, and either at once placed in a cell ready for mounting or transferred to a small specimen tube for future use. There is no harm, however, in leaving the desmids in the cork float for an indefinite length of time, if it is not convenient to proceed with them at once.

The desmids treated in this way preserve their colour fairly well, and exhibit little or no contraction, provided that they were placed in sufficient water to start with, and in slides of *Closterium* many specimens show the remarkable bodies at the tip whose movements in live specimens are so interesting. Traces of these bodies may even be seen in the accompanying illustrations (figs. 3 and 4); in the original photographs, from which the blocks were made, they are well shown. The method applies equally well to other algae, such as *Volvox* and *Spirogyra*. The latter, being so common, affords a convenient test object for showing its efficacy before experimenting on rarer algae. The arrangement of the chlorophyll bands, so characteristic of the genus, is in general beautifully preserved, the only effect on the colour being a slight darkening, which appears inevitable.

There is little or no waste of glycerine, as the same jar of glycerine may be used for several gatherings in succession. When it has become too diluted it may be concentrated by evaporation with the aid of heat, and protection from dust is not essential, as the fluid has to pass through the paper membrane before reaching the desmids. It might be useful to try whether a similar method could be used with glycerine and gum, which possesses many advantages over glycerine as a mounting medium, though the passage of gum through the parchment paper would probably be a very slow matter. Mr. Noad Clark experienced some difficulty in taking the photographs for the illustrations accompanying this paper, owing to the frustules becoming tilted on one side when the slides were placed in a vertical position. This displacement could, no doubt, be obviated by the use of glycerine and gum or some such medium, which hardens instead of remaining fluid.

(*To be continued.*)

LIFE UNDER OTHER CONDITIONS.

By Geoffrey Martin.

In last month's Science-Gossip (p. 291) I discussed the possibilities of life at far higher temperatures than are now prevalent upon the earth. I concluded that if such forms of life were possible, the central or "linking" element must have been silicon, and not carbon; further, that such life probably first originated when the earth was one great siliceous ocean of white-hot fluid. In this ocean, under the enormous temperatures and pressures that held sway, strange compounds must have been ever forming and decomposing; these reactions must have been continually going on during an enormous period of time. Is it therefore absurd to believe that at some one instant of all this time, and out of all the infinite number of compounds continually forming in billions per second, it was possible for the proper elements to come together *but once*, in such a position and in such a way as to generate the ever-decomposing compound that formed the first living being? Grant but this one primordial act of creation, whereby the germ of life inherent in matter could thrill into existence, then we can conceive that with no day of creation the whole order of creation could mechanically evolve.(1)

If in the primordial living matter silicon once played the part now played by carbon, it might be asked: How is it that it is no longer present in the organism? But the answer comes naturally if we consider the nature of life as enunciated last month. I stated that life proceeds by the continual decomposition of very complex compounds, and that their unstability is a function of the temperature, which, if too high, breaks them down completely, and renders their transitory existence impossible, while, if too low, it renders their spontaneous decomposition impossible, both conditions being equally fatal to life. Further, the temperature at which elements are capable of yielding such complexes in a state of continual decomposition differs for different elements. Thus, for carbon it is between 0° and

(1) Welby, "Nature," October 1894, p. 44.

100° C., but for silicon it is at a far higher temperature. We may call this range of temperature the *transitional range* of the element, inasmuch as these complexes are incapable of existing above this range, while below it they become stable.

Now, it is clear that, in consequence of the progressive cooling of the earth, the transitional range of silicon would soon be passed, and hence its complexes would solidify into stable masses, thus causing all life to cease. Hence, if the carbon entered more and more fully into the composition of living matter, and the silicon as steadily solidified out as the cooling continued, the transitional temperature (or temperature of continual decomposition) of living matter would become progressively lower in proportion as the amount of carbon in the organism increased, and hence the cooling of the surrounding medium, and the alteration in the living temperature of the organism, would proceed together and keep pace. The Silicon Age would thus blend imperceptibly into the Carbon Age, and when the modern thermal conditions were attained, the carbon would have long since completely replaced the silicon in the living matter, and the last era of organic existence would have been entered upon. I would, however, call attention to the fact that among some of the most rudimentary forms of organised existence, for example the diatoms and sponges, silica still remains. This might possibly be a case where the replacement of silicon by carbon is not yet quite complete.

It is therefore probable that, as the thermal condition of the earth altered, there was a corresponding alteration in the composition of living matter, the denser and less volatile elements, such as silicon, steadily solidifying out, and their places being filled by lighter and more volatile elements. But this replacement of denser by lighter elements is now almost complete, for the principal elements already present in organic matter are carbon, nitrogen, oxygen, and hydrogen; and these, it will be noticed, are the very lightest chemically active non-metallic elements. No lighter elements, then, can replace those already present in the organism, and therefore there can be no further great alteration in the temperature of living matter in the coming ages; but the world is still cooling, while the temperature of living matter is remaining almost constant. There is, even now, evidence that the mean temperature of the earth's surface is already approaching the limit of the transitional range of carbon.

Age by age, century by century, the contrast between the temperature of organic matter and the temperature of the surrounding medium is becoming more and more accentuated, and the difficulty of maintaining life is steadily increasing; indeed, life now flourishes on a far less luxuriant scale than formerly; the giant vegetation and huge monsters of the past are gone, and in their place is a dwarfed creation, better able to maintain the vital temperature on account of the smaller surface area.

At the period we are considering the earth was one great sea of molten fluid. The huge volume of water that now stretches from continent to continent and girdles the globe was then largely in a state of vapour, and together with vast quantities of other gases must have exerted an enormous pressure upon the molten surface; huge quantities of liquid must have been ever condensing in the upper regions and continually pouring upon the white-hot sea, only to be hurled aloft again, mingled with molten *débris*, in a series of vast explosions.

Who can say what strange combinations and solutions occurred at these high temperatures and enormous pressures? It is well known that under such conditions the solubility of substances in each other increases indefinitely. Most salts at their melting-points become miscible with water in all proportions; glass and many of the most insoluble bodies become freely soluble when heated highly, under enormous pressures with water, but again separate out on releasing the pressure or on lowering the temperature. The vast masses of rolling vapour and liquid that drove in huge waves across that blazing sea must then have been very complex mixtures, and in such life could well generate and maintain itself. Even when the temperature fell to such an extent that the rocks separated out in solid masses, the thick boiling fluid that remained must have differed widely in composition from the ocean of to-day, and must have held in gelatinous solution the most various substances, for the pressures would still be enormous and the temperature still high.

Such fluids as these, then, probably served as the medium wherein life flourished during the slow passage from the Silicon to the Carbon Age, and in such fluids was effected the gradual displacement in the organism of the silicon by the carbon.

Mendeléef divides the elements into a number of series, according to the magnitude of their atomic weights. Now those elements of the first and second series, which occur in matter living at ordinary temperatures—viz. hydrogen, carbon, nitrogen, and oxygen—would be too volatile to occur in matter living at, say, a white heat. Consequently they would probably be replaced by the analogous heavier and less volatile elements of the series below them: for example, instead of carbon, nitrogen, oxygen, and hydrogen, we should get silicon, phosphorus, sulphur, and, say, oxygen in the organism. To every series of elements, right up the scale, there should correspond a stage of life existing at a corresponding stage of temperature.

It appears from a short note that occurred in "Nature" (March 8th) on my article in SCIENCE-GOSSIP that Dr. F. J. Allen regards nitrogen as the central element in ordinary living matter; whereas, in my opinion, it is carbon. I am perfectly willing to admit that nitrogen is absolutely essential to the maintenance of life, because it probably causes the state of dynamical equilibrium that is supposed to exist in living organic matter. It is well known that the phenomenon of Tautomerism (Laar) is exhibited

most markedly by the nitrogen compounds—atoms of intramolecular systems oscillating between two positions *in equilibrio*, and thereby rendering the whole molecule mobile. The presence of nitrogen in a compound appears to favour the production of this intramolecular motion in a marked degree. It is evident that if nitrogen has this effect in the case of non-living carbon compounds, it will also have the same effect in the vastly more complex protoplasm, and thus enable a condition of dynamical intramolecular equilibrium to be maintained, thus giving rise to the phenomenon of life. It is significant that all living matter contains nitrogen. I might add here that the indifference shown by living matter to reagents that readily react with *dead* protoplasm may be explained as due to the stability of a system in motion. While, therefore, I regard nitrogen as the "motion-producing" element, I regard carbon as the "linking" element – the element which binds together the system, and directs and regulates the flow of atoms within the living molecule. Both carbon and nitrogen are, according to this view, equally essential to life; but it is the carbon, as the "skeleton" element, that must be regarded as the central element of the organism. I have, however, not yet had the pleasure of reading Dr. Allen's work, and consequently might be doing him an injustice.

13 *Hampton Road, Bristol,*
March 10th, 1900.

Dipterous genus Bombylius.—The spring, which will now soon be upon us, is the time when the few British species of *Bombylius* may be taken over flowers in sunny gardens and hedgerows. These very pubescent, bee-like, short, round-bodied flies with rather long narrow wings, very thin legs, and long fine proboscis, are not common, and are, I believe, chiefly local. *B. major*, the commonest species, has clear wings with a dark-brown, well-marked fore border. *B. discolor* Mik., often mistaken for *B. medius*, which is probably not a British species, is less common, and is distinguished from *B. major* by the wings being prettily sprinkled with small brown spots and the absence of the brown border. It differs from *B. medius* by the hair at tip of abdomen being quite black, not yellow like the rest of the body, as is the case in *B. medius*. The other two species are easily known from both the above by being much smaller and having unmarked wings; *B. carescens* is distinguished from *B. minor* by having long instead of short hair behind the head.—*E. Brunetti, Strand, London, W.C.*

Wasps Eating Set Insects.—Mr. Stoyel's note referring to wasps eating insects on the setting-boards reminds me that this occurred once with me during my first year's collecting, when I used to set all my specimens. I had captured in Kent a male and female *in copula* of a large species of Asilus, either *Eutolmus rufibarbis* or *Machimus rusticus*, and an hour or two after setting them in the usual way I found, to my disgust, that two or three wasps, which were still eating, had entered the open window and devoured the best part of the bodies of both insects.—*E. Brunetti, Strand, London, W.C., March* 1900.

AN INTRODUCTION TO BRITISH SPIDERS.

By Frank Percy Smith.

(*Continued from page* 310.)

FAMILY OONOPIDAE.

The spiders included in this family are very different in general appearance from the Dysderidae, although the arrangement of the eyes bears some resemblance to that of the genus *Dysdera*. The spiracular openings are very indistinct, and it is stated on good authority that there are two only. One genus is found in Britain, and that containing a single species.

GENUS *OONOPS* TEMPL.

In this genus the eyes are closely grouped and are of considerable size. The single known British species is not at all common.

Oonops pulcher Templ.

Length. Male 1.8 mm., female 2 mm.

Cephalo-thorax, legs and abdomen of a red colour. The palpal organs are simple in structure. This active little spider may be looked for in the spring. It is not common, but is found in very varied situations.

FAMILY SCYTODIDAE.

The spiders included in this family are mostly inhabitants of warm countries, one species only being found in Britain. The eyes are arranged in three pairs which form a triangle, with apex in front.

GENUS *SCYTODES* LATR.

The cephalo-thorax is of most remarkable form, its hinder portion being greatly elevated. The legs are fairly long and rather weak. Relative length 4, 1, 2, 3.

Scytodes thoracica Latr.

Length. Female 8 mm.

Cephalo-thorax yellow, marked with blackish-brown; legs yellow, slightly annulated; abdomen pale greyish-yellow, marked with blackish-brown. The palpal organs are extremely simple in structure. This spider is found, though very rarely, in buildings of various kinds.

FAMILY DRASSIDAE.

This family includes a large number of spiders, mostly of dull hue and indistinctly marked. The eyes, eight in number, are arranged in two transverse rows on the front part of the caput. The cephalo-thorax is usually somewhat depressed. The tarsal claws are two in number, and the legs are provided with spines. The abdomen is usually of a more or less cylindrical form.

GENUS *PROSTHESIMA* L. KOCH.

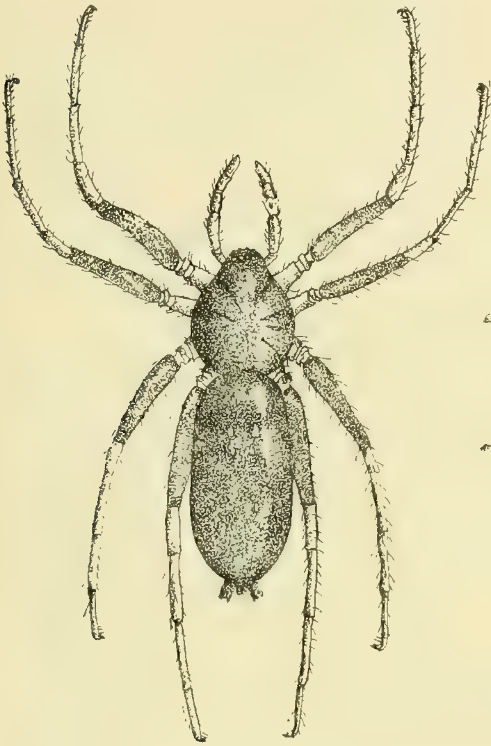
This genus contains a number of black or blackish-brown spiders, which may be distinguished from

allied genera by the point at which the palpus joins the maxilla being nearer the extremity than the base.

Prosthesima electa C. Koch. (*Drassus pumilus* Bl.)

Length. Male 4 mm.

Cephalo-thorax reddish-brown; legs, femora yellowish-red, genua and tibiae brownish-black, metatarsi and tarsi reddish-brown; abdomen black and very hairy. This species is uncommon.



Prosthesima pedestris.

Prosthesima petiverii Scop. (*Drassus ater* Bl.)

Length. Male 6.3 mm., female 6.5 mm.

Cephalo-thorax jet-black. Legs, femora black, the other joints yellowish-brown. Abdomen black, covered with thick hairs. This spider is found under rubbish and decayed bark.

Prosthesima pedestris C. Koch.

Length. Male 7.3 mm., female 7.6 mm.

Cephalo-thorax black. Legs similar to the last species. Abdomen black, much less hairy than *P. petiverii* Scop. This spider is found in similar situations to the last.

Prosthesima nigrita Fabr. (*Drassus pusillus* Bl.)

Length. Male 4.2 mm., female 4.4 mm.

Cephalo-thorax black. Legs having the metatarsal and tarsal joints of a pale grey colour. Abdomen black and rather hairy. This uncommon spider occurs in similar situations to the last.

Prosthesima lutetiana L. Koch.

Length. Female 6.3 mm.

Cephalo-thorax dark brown. Legs brown, the tarsi being reddish-brown. Abdomen blackish-brown, rather hairy. This is a rare spider; it has been found in Scotland.

Prosthesima latitans L. Koch.

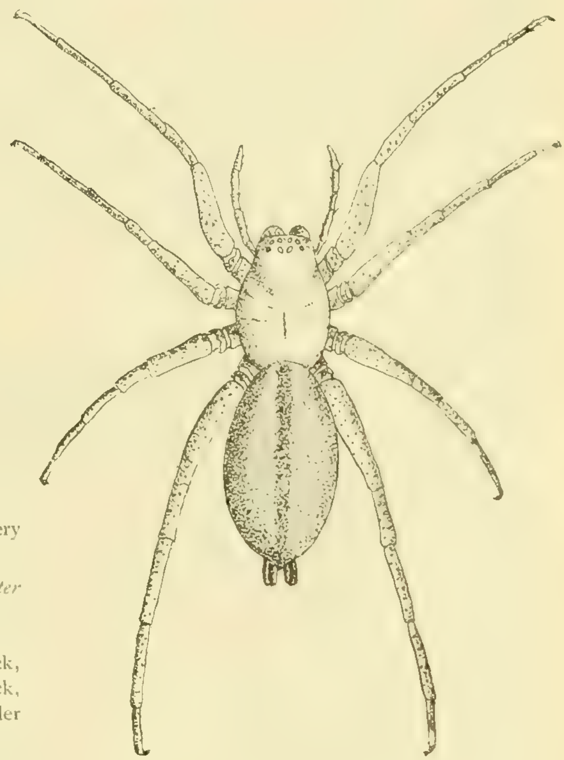
Length. Male 5.3 mm.

Cephalo-thorax black. Legs blackish-brown, the tarsi being yellow. Abdomen jet-black, hairy. This spider has been found in Dorset, and is extremely rare.

Prosthesima latreillii Sim.

Length. Male 4.3 mm., female 6.4 mm.

Cephalo-thorax blackish-brown. Legs dark brown, having the tarsi of a pale greyish-brown colour. Abdomen dull black. This spider has been found in Dorset, and is very rare.



Drassus lapidicolens.

Prosthesima longipes C. Koch.

Length. Male 4.5 mm., female 5 mm.

This spider is very similar to several of the foregoing, but may be distinguished by the much greater length of the legs. It is rare.

GENUS *GNAPHOSA* LATR.

This genus may be distinguished by the curve of the hinder row of eyes, being directed forward.

Gnaphosa anglica Cambr. (*Drassus lucifugus* Bl.)

Length. Male 6.2 mm., female 6.5 mm.

Cephalo-thorax dark brown, marked with a darker tint. Legs dark brown. Abdomen glossy black and rather hairy. This species is very rare.

Gnaphosa lugubris C. Koch.

Length. Male 9 mm., female 11.5 mm.

This spider is very similar to the last, but is larger. It is extremely rare.

Gnaphosa lucifuga Bl.

This species is closely allied to *G. lugubris*.

Gnaphosa suspecta Cambr.

Cephalo-thorax yellowish-brown, with a marginal line of a darker hue. Legs yellow-brown. Abdomen dark brown, covered with pubescence of a paler colour.

GENUS *DRASSUS* WALCK.

The eyes in this genus are arranged in two transverse curved rows, the curves being directed away from one another, thus enclosing a somewhat oval space. The spiders included in this genus are chiefly dull in colour, and possess few markings. The species in many cases can only be distinguished with difficulty.

Drassus blackwallii Thor. (*Drassus sericeus* Bl.)

Length. Male 8.4 mm., female 9 mm.

Cephalo-thorax dark reddish-brown. Abdomen exceedingly hairy. This spider is not uncommon, and is apparently always found in houses. Like many of its allies, unless disturbed it only leaves its tubular retreat at night.

Drassus infuscatus Westr.

Length. Female 7.7 mm.

This rare spider can be readily distinguished from its allies by the form of the genital aperture.

Drassus ferrugineus Bl.

Length. Female 12.5 mm.

Cephalo-thorax reddish-brown. Legs similar in colour. Abdomen cream-coloured. This spider is very rare, and has been recorded from Belfast.

Drassus troglodytes C. Koch.

Length. Male 8 mm., female 8.5 mm.

Cephalo-thorax and legs dull brown. Abdomen dark brown and hairy, with some indistinct markings. This spider is rare and local. I have received it from Norwich.

Drassus braccatus L. Koch. (*D. bulbifer* Cambr.)

Length. Male 4.5 mm.

Cephalo-thorax bright reddish-brown. Legs yellow, with femora of first and second pairs black. Abdomen black and hairy, with white markings. This rare spider has been recorded from Dorset and Hastings.

Drassus lapidicolens Walck.

Length. Male 10.5 mm., female 12 mm.

Cephalo-thorax and legs yellowish-brown. Abdomen dull greyish-brown with an indistinct marking. This is by far the commonest spider of the genus, and is found in all parts of the country, under logs and decayed bark.

Drassus reticulatus Bl.

Length. Female 10 mm.

Cephalo-thorax and legs yellowish-brown. Abdomen pale olive-brown, reticulated with fine yellowish-white lines. This extremely rare spider has been recorded from Lancaster.

Drassus cupreus Bl.

Length. Male 9 mm., female 10 mm.

Cephalo-thorax and legs reddish-brown. Abdomen coppery-red with a blackish band on the upper side.

Drassus silvestris Bl.

Length. Male 9 mm., female 10 mm.

Cephalo-thorax and legs reddish-brown. Abdomen olive-brown, with a darker marking along its upper side. This rare spider is recorded from Berwick. I have received it recently from Norwich.

The spider described as *D. criminalis* Cambr. in "Spiders of Dorset" seems to be an immature form of this species.

Drassus pubescens Thor.

Length. Male 7 mm., female 7.5 mm.

This spider is similar to *D. lapidicolens* Walck, but is much smaller.

Drassus minor Cambr.

Cephalo-thorax yellowish-brown. Legs pale yellowish-brown. Abdomen dark brown, with a darker band along the upper side.

This spider is rare, and has been recorded from Portland.

Drassus delinquens Cambr.

Length. Male 4.2 mm., female 5.6 mm.

Cephalo-thorax yellowish-brown with dark markings. Legs pale yellowish-brown. Abdomen dark yellowish-brown, with a darker marking on the upper side. This rare spider has been found in Dorsetshire.

(*To be continued.*)

A LADY LL.D.—The University of Edinburgh has granted the honorary degree of LL.D. to Miss Eleanor A. Ormerod, the well-known economic entomologist. This is the first instance of the University granting the honorary degree to a lady. Miss Ormerod and her late sister, who greatly helped in the work, were the daughters of Mr. George Ormerod, of Sedbury Park, Gloucestershire, and Tyldesley, Lancashire, D.C.L., F.R.S. Miss Ormerod was at one time examiner in agricultural entomology in the University of Edinburgh. Last year she was awarded a silver medal by the Société Nationale d'Acclimatation de France. We congratulate Miss Ormerod.

THE BALTIC AMBER MINES.

By M. Lane.

(*Concluded from page* 274.)

THE cliff above the mines is a headland near the sea of about sixty feet in height. It consists of a thin stratum of vegetable earth at the top and a deep vein of dark blue clay underneath. This clay is the repository of vegetable and animal fossils. Here beyond doubt for the first time the real origin of amber has been established. Those who have wandered through a fir or pine wood must have seen the yellow sap running from more or less slight mounds in the bark of the trees. It trickles down in globular or pear-shaped drops; also it forms pegs, or like breast-plates of armour surrounds the tree-trunks. All these shapes, and many more, are repeated in pieces of amber found in the blue clay. There it came to us, as it were, out of the hands of Nature itself, not smoothed, polished and altered in shape by the waves of the sea. One sees drops of all shapes and sizes, some as big as a hen's egg, the size of a walnut or a hazel-nut; some are globular, others pear-shaped, some smooth, others wrinkled when the liquid mass dried too quickly. Now and then pieces have been flattened by having while still soft suddenly dropped to the ground. Sometimes there is found an already hardened drop enclosed in another piece, or flies, gnats, spiders, beetles, bees, and ants caught by the liquid mass. Thus embalmed in a transparent medium, they are handed down to wondering posterity. Mosses, tiny leaves, twigs, or catkins of coniferous trees are more rarely enclosed.

A small fee paid to the miners' hospital fund entitles visitors to see the works. To the same charitable institution the money goes for the views and small amber collections sold on the premises. Of the three mines, one has been worked for a few years only, another is exhausted, and the third is that for which we were bourd. It lies near the fishing village of Kraxtepellen, ten minutes' walk from the counting-house and other parts of the works, which are close to the railway station. A tram line runs straight across the fields, in order to convey wood, coals, and other necessaries to the miners. We chose a foot-path passing through the village, then along the sea. We had then to cross a deep winding glen whose little stream forms a cove, where on white sands the fishermen dry their nets and shelter their boats in stormy weather. The glen was gay with bright autumn flowers and red haws. The orange-coloured berries of the sea-buckthorn were also conspicuous. Having crossed the streamlet on a wooden plank, and climbed the steep bank opposite, we came across a part of the village which lies in ruins. The roofs of the cottages have sunk in; the black holes of the windows and doors stared at us like lifeless eyes; while the walls showed cracks and fissures, as if an earthquake had shaken their foundations. Not subterranean fires, however, but human activity had wrought these devastations. The neighbouring fields, too, lie waste; they are railed in, and placards everywhere warn everybody from going within the fence-rails. Under fields and houses run numerous passages, shown by the oddly hooded air-shafts that rise in the fields like gigantic mushrooms. After having passed those fields, we descended a slope, and were in sight of the works. Some weather-beaten posts and palings sticking out from the brow of the cliff were, we are told, remains of an old shaft dug about a century ago, but soon abandoned.

The buildings above the ground at the mine form a square, fenced in on all sides. In one of the long wooden sheds the main entrance of the mine is situated. It is a big square black hole, with a steep ladder for descending. On a blackboard above, the number of workmen occupied in the mine is written in chalk; also the number of bags in which the foremen put particularly valuable pieces of amber, for which special rewards are given. Along the walls of the shed there hang the workmen's clothes and tools, in rough cupboards, for the place also serves as a dressing-room.

The mine is not very deep. Tram rails lead from the main shaft into an intricacy of passages. Deep square two-wheeled carts, drawn by horses, run on the rails. For weeks these animals do not see the upper world. The workmen break the clay off and throw it into the carts, which are taken to the lifts, and with the regularity of clockwork a full cart rises while an empty one descends. The contents are emptied into a long wooden trough, which is inclined at an angle of sixty to seventy degrees, and in it wire gratings are fastened vertically at certain distances from each other. A swift strong current of water is constantly rushing along the channel, washing away the clay and at the same time leaving the amber against the gratings, which, becoming more and more narrow, sort the pieces according to their size. Then it is put into big rotating wooden barrels, where it is cleansed from all impurities that may still cling to the pieces. Afterwards factory girls sort it again, according to its colour.

Large pieces of amber being rare, a process has been invented for pressing small bits of the same colour into big lumps, in order to cut large objects from them. This is now so well done that only an

initiated eye can trace the amalgamation. This procedure, as well as that of dyeing amber black and green—colours which are very rarely found in nature—are secrets of the firm, and the public is not allowed to enter the premises where this kind of work is done.

The smallest bits of amber are used for making varnish. They are first dried in the sun and then before a fire. The varnish factory lies at a considerable distance from the other premises, and for good reasons. Some years ago a fire caused by an explosion broke out in one of the sheds, and the flames spread rapidly. They soon attacked a tank filled with an oily substance, the residue of amber varnish, for which no use has yet been found. Unfortunately the tank was brimful, and therefore, before the flames could be extinguished, they had first to consume part of the mineral oil. For some time the country around was enveloped in a cloud of jet-black smoke rolling slowly above the ground. When the fire-engines at last began to play, a never-to-be-forgotten sight ensued. The flames leaped up into the air hundreds of feet high, and, roaring, they formed a huge fiery tower which illuminated the country for miles around.

In returning from the mine we strolled through the village, which, notwithstanding the ruined cottages, has a thriving appearance. There are brick houses with white curtains and flower-pots behind the bright windows ; there are paved straight streets with their names in white letters on a blue background at the corners. The principal street has rows of lime-trees on either side, whose foliage, it is true, gives for the present only a scanty shade. A small church, brannew like the houses, stands not far off. Not all the more picturesque old cottages, however, have disappeared. Here are some with thatched roofs where toy-boats with white sails and gay streamers are merrily turning round and round in the fresh breeze ; while others have on their gables two roughly carved pieces of wood nailed crosswise, meant to represent horses' heads. These emblems of Wotan's sacred animal, the horse, show how firmly old customs and traditions are rooted in the minds of country folk. What would those good Christians say if they were told that by finishing off their gable-ends with these ornaments they called upon the chief god of their heathenish forefathers for help and protection against fire and strife ?

We had now reached the house which was formerly the principal mansion of Palmnicken. It has been turned into an hotel, the old premises being by far too small for the increase of visitors. The grounds are extensive ; there and in the adjoining woods one can ramble for hours. Old elms, oaks, limes, and chestnut-trees shelter against cold winds their less sturdy comrades, brought hither from milder climates. There are wide lawns with flower-beds, seats in shaded nooks, some with a view of the sea, whose chief charm seems to be its solitude. The sun throws a wide track of glittering light across the waters, but only a seagull now and then or a fishing-boat crosses this golden bridge.

In one of the busy streets of Königsberg the amber merchants owned a large house, where the ground floor is occupied by offices, and the second story by a museum, which is open to the public twice a week. It contains the largest amber collection in the world. The walls are painted, and represent views of the works at Palmnicken, the colony at Schwarzart, the settlement at Brüsterart, and sketches from the Baltic shores. Along the walls the history can be followed of how amber has been used from heathenish times to the present day. Here are ornaments found in the barrows of the ancient inhabitants of this part of Prussia, such as links, clasps, beads, and amulets, with roughly cut figures of men and animals. There are also ornaments and rosaries from the early Christian era. Often stone was used for inlaid work. Boxes, brushes, powder-horns, and shrines were inlaid with differently coloured amber. Handles of knives, forks, and spoons were also cut out of it. Later, amber became the indispensable material for the mouthpieces of pipes. An enormous percentage of the amber yearly obtained is used for this purpose in all parts of the world. Their shapes have been adapted to the tastes of the nations for whom they are destined, so that we can find in the collection the red pipe of the Koreans as well as the glass pipe of the Chinese.

Strings of amber beads for necklaces and bracelets have always been favourites with the fair sex in southern countries. There are beads of opaque amber for Egypt ; others yellow and transparent, cut in facets, for India and Algeria ; some flat and reddish for Persia ; others olive-shaped for the countries on the Danube. Small pearl-like beads of the most valuable or butter-coloured amber are principally worn in the West of Europe. Unshapely necklaces are exported to the negro tribes on the Sierra Leone coast. Big irregular pieces of the transparent kind are so polished that all their irregularities are retained. Then they are pierced, and the largest lumps, of the size of a baby's fist, strung in the middle with the smaller ones on either side. There also are rosaries for Mahometans ; small scent-bottles, just large enough to hold a few drops of attar of rose, for Turkey ; some in the shape of an acorn fastened by a tiny chain to an amber finger-ring ; three-cornered amulets for China ; ear-pegs for Africans ; and, above all, a variety of ornaments and dainty nicknacks to be bought and taken away by the yearly increasing number of visitors to the Baltic shores.

The glass cases in the middle of the room contain most valuable material for scientific research. Specimens of the fossil flora and fauna found in the blue clay can be seen there, as well as the different shapes and forms which amber takes. Here, too, are polished pieces, illustrating its native colouring—ivory, spotted, streaked, opaque, transparent ; in short, from creamy-white to warm bright yellow, that sparkles like crystallised sunbeams. There are

innumerable bits having many substances enclosed. Entomologists come here to study the insects of prehistoric periods. Species of ants have been discovered which once lived on the Baltic coast and now are only found in countries of the southern hemisphere

Parts of the collection consist of amber found in other countries, such as Sicily, India, and Burmah. There are also the dry gums of trees—copal, for instance—to be compared with the fossil gum ; and, lastly, there are the minerals which have been found with amber. Two of these, hitherto undescribed, have for obvious reasons been called Stantienite and Beckerite. In a conspicuous place on a bracket against the wall there can be seen the largest piece of amber obtained from the mines, a lump two feet long, six inches thick, and weighing about twelve pounds.

Quite recently the Prussian Government has purchased all the interests of the shareholders in the company that acquired the mines from the amber merchants and which latterly worked them.

Once again we left Königsberg and its amber museum, this time with the impression that, through the mines of Palmnicken, the nature and origin of amber are established beyond doubt. This once precious material is now produced from these mines in such quantities as to place it within the reach of every one in its manifold uses.

BUTTERFLIES OF THE PALAEARCTIC REGION.

BY HENRY CHARLES LANG, M.D., M.R.C.S., L.R.C.P. LOND.

(*Continued from page* 299.)

FAMILY II.

PIERIDAE.

LARVA.—Cylindrical, smooth or pubescent, not spiny. Slightly tapering at the extremities. Never with retractile forks. Colour generally either brown or green.

PUPA.—Generally angulated, sometimes very slender, attached at the caudal end, and with a thoracic girth as in the family Papilionidae. Usually of a light grey or green colour, sometimes speckled with black.

IMAGO.—Usually of medium size, sometimes small. Wings rounded or occasionally pointed at the apices, but never tailed or emarginate. In. marg. h.w. never concave, but forming a channel or groove for the abdomen, a character which at once separates this family from the Papilionidae. Antennae of moderate length or short ; clubs ovate, not recurved. Discoidal cell closed. Internal nervure f.w. wanting. Anterior legs in ♂ and ♀ perfect. Tibiae without spines. Prevailing colour of wings white or yellow, varying from greenish to reddish-orange. No ocellated spots, except on u.s. of h.w. of some species. Generally a simple black disc. spot on f.w.

This is a very extensive family, occurring in nearly every part of the world. It is by far most numerously represented near the Equator. Many of the tropical species display great brilliancy of colouring, and sometimes depart from the general rule of white and yellow, to exhibit tints of red or blue.

We are very familiar with some of our British species of the Pieridae. The common "whites"—*Pieris brassicae*, *P. rapae*, and *P. napi*—being abundant everywhere in this country ; even occasionally to be seen in the streets of crowded cities. It is no infrequent thing to meet with *P. rapae,* the "common white," in the heart of London. The beautiful "orange-tip" *Anthocharis cardamines* must be familiar as a spring butterfly to every one who is not absolutely confined to city streets. In the South of England "the brimstone-butterfly" (*Rhodocera rhamni*) is generally welcomed as the herald of spring, and perhaps from its yellow colour gave origin to the word "butterfly" itself. The "clouded yellow" (*Colias edusa*) with its beautiful golden wings is to be found on chalk downs and in clover-fields almost every year in the south-eastern counties, but occasionally multiplies itself so greatly as to spread in great numbers over the length and breadth of the British Islands. The years 1877 and 1892 were famous for its general appearance. In the latter year the rarer *Colias hyale*, "the light clouded yellow," occurred at the same time in considerable numbers, and was very common in many places. Three other species of Pieridae are British, viz. *Leucophasia sinapis*, "the wood white," always local and now less common than formerly. *Aporia crataegi*, "the black-veined white," was once not uncommon in Southern England, but became in the latter years of the nineteenth century very scarce in our islands, and for a time was looked upon as on the verge of extinction. Fortunately it has reappeared in some of its old Kentish localities, and it is to be hoped has re-established itself. The remaining British species, *Pieris daplidice*, "the Bath white," has always been rare in Britain, and only occurs sporadically and occasionally.

On the continent of Europe the Pieridae are well represented. *Aporia crataegi* is very plentiful, and widely distributed in almost all countries. In some districts it is a highly noxious insect, the larvae being gregarious and devastating not only thorn-trees, but fruit-bearing trees of all kinds in orchards. This species is abundant in sub-Alpine districts, and strikingly resembles in its appearance and flight members of the genus *Parnassius*.

The common British species of *Pieris* are also abundant throughout Europe, including *P. daplidice*, alluded to as being so rare in Britain. There is another species found in all the Alpine regions at high elevations, *P. callidice*; whilst in Russia and Turkey occurs yet one more species, *P. chloridice*, a butterfly of delicate appearance and colouring. In Greece *P. krueperi*, a Western Asiatic species, reaches Europe, but is exceedingly local, its proper habitat being Asia Minor and Persia.

In the next genus, *Anthocharis*, of which our common "orange-tip" is the most widely distributed, there are several other orange-tipped species, one of which is of common occurrence on the Mediterranean littoral, also generally in Southern France and Italy. This is the beautiful "aurore de Provence," the male having bright yellow wings, accompanied by marvellously brilliant tips of reddish-orange to the fore wings. This species is common in the spring, and I have seen it at Nice as late as the beginning of July. The most beautiful European species is *A. damone* which, with the smaller *A. gruneri*, is found in the South-east of Europe. There are several closely allied forms of the genus in which the orange patch is altogether absent; but the hind wings are beautifully marked with green and silvery spots or stripes. These are *A. belemia*, *A. belia*, and *A. tagis*. All these species exhibit local varieties and seasonal dimorphic forms.

There is a genus closely allied to *Anthocharis* that has no British representative. This is *Zegris*, containing two species found in Europe, *Z. eupheme* and *Z. pyrothoe*. The first of these occurs in Spain, and also in Russia; the second belongs more truly to Western and Central Asia, but is found in the province of Orenburg in East Russia. These species are "orange-tips" in both sexes.

In the genus *Leucophasia*, *L. sinapis*, "the wood white," is common throughout Europe. There is an additional species, quite distinct, but in Europe almost entirely confined to Southern France and North Italy. This is *L. duponcheli*.

The "Clouded Yellows" are represented on the continent of Europe by several species in addition to our *Colias edusa* and *C. hyale*. Some of these are alpine, *C. palaeno* and *C. phicomone*; some boreal, *C. nastes* and *C. hecla*; others, *C. chrysotheme* and *C. myrmidone*, are only found in Eastern Europe; whilst *C. erate* only occurs in South Russia. One more species, *C. heldreich*, a species allied to *C. edusa*, inhabits exclusively the mountains of Northern Greece.

In the genus *Rhodocera*, besides *R. rhamni* there exists a second species, *R. cleopatra*, which is generally distributed over the South of Europe. No one who cares about butterflies is ever likely to forget his first sight of this superb species, with its wonderful colouring of bright yellow and deep orange. This and *Anthocharis euphenoides* are among the most brilliantly coloured of the European Pieridae. They may frequently be seen flying in the same localities and at the same time in the warm southern sunshine.

Outside Europe the majority of the Pieridae of the Palaearctic Region are inhabitants of Central Asia. There are, however, one or two genera which have the majority of their species in other regions, such as *Callydrias* and *Idmais*, which are represented in Syria. A remarkable species from the mountains of Central Asia has been referred to a new genus, *Mesapia*; the one species, *M. peloria*, was at its first discovery included in the Papilionidae and was placed near to *Parnassius*. It is, however, a true Pierid, and it is open to question whether there are sufficient grounds for separating it from the genus *Aporia*.

There are two other species that have been referred to the genus *Aporia*, as *A. hippia* from Siberia and *A. kreitneri* from Central Asia, which have a striking superficial resemblance to *A. crataegi*; but I certainly agree with Mr. W. F. Kirby that they cannot be placed with that species for reasons which will appear later. The confusion caused by modern nomenclators in the generic division of the Pieridae makes one almost inclined to group *Mesapia*, *Pieris*, *Anthocharis*, *Zegris*, *Leucophasia*, and *Idmais* together, under the old Fabrician genus *Pontia* and the remainder under *Colias*. The commonly received method on the Continent is however simple enough, and therefore I shall retain it here as elsewhere in my description of the Palaearctic butterflies. In this case, however, I refer these two species provisionally to the genus *Pieris*, admitting only one species of *Aporia*—viz. *A. crataegi*.

In *Pieris*, *P. leucodice* found in Persia and Turkestan, *P. davidis* occurring in Central Asia, and *P. mesentina* in Syria represent groups of the genus that have no European allies. *P. cheiranthi* and *P. wollostoni* in the Canaries and Madeira were probably at one time local races of *P. brassicae*, to which species *P. canidia* and *P. deota* are nearly allied. *P. tadjika* is very close to *P. rapae*, whilst *P. melete*, common in the Amur, *P. ochsenheimeri* in Turkestan, and perhaps the Central Asian *P. butleri*, are allies of *P. napi*.

In the genus *Anthocharis* there are several species allied to *A. belia* with yellow instead of white wings, and of small expanse. These, *P. charlonia*, *P. levaillantii* and *P. mesopotamiea*, inhabit South-west Asia and North Africa. *A. fallowi* in North Africa is very closely allied to the European *A. belemia*. The same region furnishes *A. eupheno*, which is by some lepidopterists considered to be the type of which the European *A. euphenoides* is a variety. *A. nouna* from the same regions has by some been relegated to another genus, as has likewise *A. bieti*, a Central Asian species much resembling *A. cardamines* in colour and pattern, but with the apices of the fore wings acuminate, like those of *R. rhamni*. A very distinct species of *Zegris* occurs in the Amur, *Z. fausti*, which has the tips of the wings of a bright reddish-orange.

The genus *Idmais*, which is chiefly represented in

Africa, extends into Syria, and the two species found there are most remarkable for the delicate salmon colour of their wings.

One species of the tropical genus *Callidryas* occurs in Syria, a rather large butterfly with white wings.

Another genus chiefly represented in the Indo-Australian region, *Terias*, has two representatives in Corea.

The only Palaearctic *Leucophasia* that is not European is *L. amurensis*, common in the Amur district. It somewhat resembles *L. sinapis*, but is larger and with pointed fore wings.

The most beautiful and at the same time most interesting species of the genus *Colias* are found in Central Asia, which, as in the case of *Parnassius*, may be said to be the headquarters of the genus. It is not necessary to mention them here, as they will be enumerated later, but attention may be called to *C. sagartia*, a magnificent "light clouded yellow" found in Persia; to *C. wiskotti* and its varieties in Turkestan, where many grand orange-coloured species of the genus are found, the most beautiful being *C. erschoffi*, *C. christophi*, *C. eogene*, and *C. regia*, the last being perhaps the most intensely coloured of all the orange Coliades. The tint of the wings is almost red, and often, like those of many of its congeners, shot with violet. Perhaps the largest and finest *Colias* is *C. aurora*, common in Eastern Siberia; but *C. olga* from the Asiatic Caucasus equals it in brilliancy. All the orange species are most interesting from the fact of their close alliance to our familiar clouded yellow, *C. edusa*. The genus *Colias*, as in the case of that of *Parnassius*, is an object-lesson in the study of evolution, which can never be without great interest for investigation by the zoologist.

The Palaearctic Rhodocerae are enriched by two distinct species not occurring in Europe—*Rhodocera aspasia*, from the Amur, that has the wings more sharply angulated than any European species; and *R. gleobule*, from Madeira and the Canaries, in which the wings exhibit the minimum of angularity, and have the orange colour seen in *R. cleopatra*, though less brilliant, occupying the entire surface of the f.w.

Genus 8. *MESAPIA* Gray.

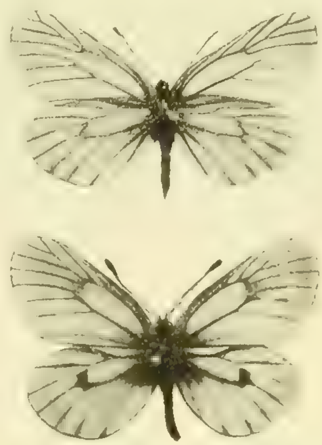
This genus was named by Gray in Lep. Brit. Mus. 1, p. 92 (1856).

Rather small butterflies, with rounded wings. The fore wings especially with a rotundity of outline not seen in any other Palaearctic Pieridae. Wings more or less semitransparent, with broadly marked dark lines following the neuration. The white of the ground colour tinged with yellowish or brown. Beneath, the h.w. show a good deal of yellow coloration. Neuration peculiar, resulting from the discoidal cells being short, broad, and not angulated; the second subcostal nervule given off at some distance from the end of the discoidal cell. All the wings with a black discoidal spot towards the outer end of the cell. Wings distinctly fringed, and black at the base; body hairy, long in proportion to wings. Antennae long in proportion to size of insect, and with large ovate clubs.

M. peloria Hewitson. (*Pieris peloria.*) Ex Butt. I. Pieridae 1853, *Aporia peloria* R. and H. p. 118.

38—40 mm.

Wings rounded in outline, semitransparent towards ou. marg. in ♂, more extensively so in ♀. Ground colour white towards base, more or less tinged towards outer margin with yellowish or brownish. Course of nervures marked with black suddenly broadening out at outer margins to form triangular



Mesapia peloria, ♂ ♀.

spots on h.w. Base of all the wings black, that of h.w. most markedly so. In ♂ a distinct black spot at the extremity of the disc. cell in both f. and h.w. The disc. spot less strongly marked in ♀, sometimes absent. Head, thorax, and abdomen black, the latter reaching slightly beyond an. ang. of h.w. and clothed with hairs. Antennae black with large clubs. Legs black. U.s. ♂ f.w. white, marked as above, but stripes narrower; disc. spot indistinct. U.w. bright ochre-yellow with black veins following neuration; discoidal spot absent. ♀ almost entirely white with black or dusky markings following the neuration, a very little yellow towards base of h.w.

HAB. At great altitudes above the forest region of N. Mongolia and Thibet. VII.m.

The peculiar-shaped wings, together with the black body and basal shading, and the large antennae give to this species at first sight the appearance of a neuropterous insect.

Genus 9. *APORIA.* Hub. Verz. bek. Schmett. p. 90 (1816).

Wings not so rounded as in *Mesapia*, with, practically, no marginal fringes. Thinly scaled. White, without any markings, except sometimes a long

narrow disc. spot f.w. and a slight duskiness at the out. marginal extremities of nervures in f.w. Second subcostal nervule thrown off at the extreme end of the cell. Neuration very conspicuous. U.s. without yellow markings. Antennae long, with elongated clubs. Only one species.

1. A. **crataegi** L. Syst. Nat. 1, p. 467 (1758). Lg. B.E. p. 27, pl. 6, fig. 1, pl. 15, fig. 1. "The black-veined white."

46—62 mm.

All the wings white, more or less sub-diaphanous, more so in ♀ than in ♂, without marginal fringe.

Aporia crataegi.

The neuration black. No markings either above or below except sometimes a narrow disc. spot on f.w. and some dusky triangular patches of scales along out. marg. on f.w. at the extremity of the nervules. Antennae, head, thorax, and abdomen black. Body slightly downy. U.s. as above.

Hab. The entire Palaearctic Region, except N. Lapland, Syria, and the North American portion. A very common insect in many parts of Central Europe. V.–VI. Rare and local in England, once common, but now only found in Kent.

Larva. Covered with a white down, sides and ventral surface lead-coloured. Dorsal surface marked with two longitudinal yellowish bands. Feeds gregariously on hawthorn (*Crataegus*), sloe and wild cherry (*Prunus*), and other fruit trees. IV.–V.

Pupa. Greenish-white, with two lateral lines of a yellow colour, and with numerous black points.

(*To be continued.*)

To Clean Coral.—Cut some common brown or "Sunlight" soap into thin slices, and boil till dissolved. Then fill a larger saucepan so as to cover the coral with water, and add the dissolved soap with some washing soda. Place the coral so that the dirt will fall out of, not into the recesses of the specimen, and boil for ten minutes. Then rinse in clean hot water, finishing with cold water. *Euplectella* may be cleaned by simply dipping into the boiling water and rinsing in clean warm water. The amount of soap and soda, and the time of boiling, must be judged by the circumstances. I have found coral well cleaned with a few minutes' boiling, or it may be boiled for an hour without injury.—*E. Barker*, 41 *Melrose Gardens, London, W.*

A HISTORY OF CHALK.

By Edward A. Martin, F.G.S.

(*Continued from page* 307.)

The Upper Cretaceous sea had a considerably wider extension than that of the Lower Cretaceous or Neocomian period. In the Wealden area we find the various subdivisions of the lower portion of the system recurring with regularity, one above the other; but, in consequence of the widening of the sea, the deposits laid down in the later beds came to overlap the earlier beds. Thus the extreme westerly outliers of the Upper Greensand occur upon Triassic strata in Devonshire, while the Gault where it outcrops west of the great escarpment occurs unconformably upon the later members of the Jurassic, as far as the outcrop of the Kimmeridge Clay.

Where the Gault and Upper Greensand occur in superposition we have good evidence of their deposition having taken place in undisturbed succession. There is no great break shown in an examination of their fossil contents, the differences being such as might be expected from the different nature of their lithological characters. The Gault Clay was undoubtedly brought together by a process of calm undisturbed deposition far out at sea, and at such a distance from land as to render it impossible for the ordinary sandy waste and *débris* of a coast to have been transported thither. Only the finer clay was borne, finally to sink to rest at the bottom of the sea, entombing many representatives of the pelagic life of the period. The lower portions of the rock are especially rich in fossil remains, and show that it was formed in a sea which was gradually deepening. The Clay, where it occurs in its pure recognisable form, is of a dark blue-grey tint, and contains many mica-flakes. In some localities, such as at East Wear Bay, near Folkestone, there is a large amount of iron-pyrites contained in the Lower Gault. The Upper Gault here develops grey marly beds, indicating a deepening of the sea in which they were deposited. Layers of concretions of phosphate of lime also occur.

The thickness of the Gault varies considerably at different points. The most reliable information on this head has been obtained from borings which have been made in the London basin in search of water, the thickness in these cases being as follows:—Tottenham Court Road, 160 feet; Crossness (Blackwall), 176 feet; Ware (Herts), 160 feet; Turnford (Cheshunt), 164 feet; Kentish Town, 130½ feet; Richmond (Surrey), 201½ feet; Chatham Dockyard, 193 feet; Streatham, 188 feet; Dover Convict Prison, 143 feet; Farnham Waterworks, 152 feet; Caterham Waterworks, 343 feet; Culford (Eastern Counties Coal-boring Association), 49½ feet. It must, however, be remembered, in connection with measurements of thicknesses obtained from borings, that they are vertical plumb-line measurements, and are not necessarily measured at right angles to

the plane of the stratum in question, unless such stratum still retains the horizontal position.

In tracing northward the outcrop of the Gault, as it appears on the west of the line of chalk hills known as the Chiltern Hills, Gog Magog Hills, and the Norfolk Wolds, it commences to decrease in thickness, developing in its upper part beds of a calcareous nature. When again looked for in the north of Norfolk, it has lost its clay character, and, instead, appears as what has been called Red Chalk, or Hunstanton Limestone, a Chalk of a reddish hue, and still containing a large proportion of clay.

There is no doubt now that the greater part of the Upper Greensand was formed contemporaneously with at least the upper portions of the Gault clay in other districts. For this reason it is impossible to deal with the two as distinct formations, although they differ so greatly lithologically. The Gault itself is as a rule easily recognisable, but not so the Upper Greensand, which varies greatly in different parts, being sometimes a sandy marl, at other times a true Greensand, containing glauconitic grains, whilst sometimes the sands are coloured yellow and grey, and consist chiefly of quartz and mica. As we watch the outcrop of the formation from beneath the Chalk on the west of the chalk hills which extend from Salisbury Plain to Norfolk, we see the character of the rocks gradually alter, assuming a more and more clayey nature, until it also appears finally to pass into the red clayey-limestone of Hunstanton before referred to.

Red Chalk is also developed in Yorkshire, and derives its colour from containing about 4 per cent. of oxide of iron. When treated with acids it leaves a distinct argillaceous residue behind, consisting of alumina and oxide of iron, with a small proportion of magnesia and potash. In composition it seems to be comparable in some respects with the Red Clays which have been referred to in discussing the question of deep-sea deposits.

The Upper Greensand occurs uniformly above the Gault around the Wealden area, although it is wanting in Mid-Kent. Together with the Gault it has taken part in those great earth-movements which folded the Weald into its present conformation, and which probably affect all the underlying rocks down to the denuded Carboniferous land surface. It is of no great thickness, varying from 3 feet to 130 feet, and often is unrecognisable as a sand. After the deposition of the Gault there was apparently a gradual upheaval of the sea-bottom, the Upper Greensand being deposited in shallower waters, and being derived from the waste of not very far distant land. Around the Weald there was little or no disturbing element to the equable deposition of this series, but during the same period the more westerly earth-movements appear to have been such as to give rise to strata of more varied constitution. It is a remarkable fact that the Gault rests at Ware, as shown by a boring, immediately upon Silurian strata, whilst at Cheshunt (Turnford) there is nothing between it and strata of Devonian age. So that during great part of both Primary and Secondary epochs these spots were apparently dry land, becoming at last submerged beneath the Gault sea. When a change again came and the sea became shallower the sea-deposit was of a different nature, and with the rise of Primary rocks somewhere in the neighbourhood these became denuded, and their "derived" fossils were mixed up with the new shallow-water deposit there forming.

(To be continued.)

BRITISH FRESHWATER MITES.

By Charles D. Soar, F.R.M.S.

(Continued from page 303.)

GENUS *HYDRACHNA* MÜLLER.

The name *Hydrachna* was given by Müller in 1781 to all the water mites described by him; but Koch divided the family into a number of genera, which have since been much increased, thus leaving only a comparatively small number of species in the genus *Hydrachna*. It contains, as far as I have been able to ascertain, about thirty-three species;

Fig. 1. *H. globosa*. Ventral surface.

but at present I have very few to report from Britain. Piersig records seventeen for Germany.

The characteristics of this genus are: Body soft-skinned, swimming hairs to all legs, mouth organ extending as far forward as the palpi.

1. *Hydrachna globosa* de Goer, 1778.

Body.—Nearly circular in form, and very thick, and, as its name suggests, globular. Length about 2.30 mm., width about 2.15 mm. Colour a bright red. Eyes rather close together. Behind each eye is a chitinous plate (fig. 2), which is the principal point of identity in this species. Between these two dorsal plates is what appears to be another

small eye, similar to those we found in species of the genus *Hydryphantes.*

LEGS.—First pair about 1.30 mm. long; fourth pair extend to about 2.30 mm. Red in colour, same as body. In some cases slightly yellow near the joints. All the legs are well supplied with swimming hairs, and those on the fourth pair of legs are very long. Claws to all feet.

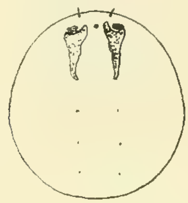


FIG. 2. *H. globosa.* Dorsal surface.

EPIMERA.—Arranged in four groups (fig. 1). The plates are rather small in proportion to size of body, but are very plain and distinct, being a little darker in colour than the other part of the ventral surface.

PALPI.—About 0.7 mm. in length, rather hairy, but quite without the pegs we have found in some species before mentioned.

GENITAL AREA.—Composed of one heart-shaped plate, covered with a large number of small discs.

There is little difference in structure in the sexes. The general form is much the same, the male as usual being a little smaller.

FIG. 3. *H. scutata.* Dorsal plate.

LOCALITIES.—Fairly common in England. Mr. Taverner has found this mite in Scotland.

2. *Hydrachna scutata* Piersig, 1897.

BODY.—Very much the same shape as that of the preceding mite. About 2.40 mm. in length. Red in colour, sometimes of a darker shade than *H. globosa.* The principal point of identity between the last species and this mite is the chitinous plate between the eyes (Fig. 3). This plate is all in one piece, but is not always quite so symmetrical in its outline as drawn; but still this is sufficiently near the form. In this species the median eye, if indeed this is an eye, is situated on the plate, similar to those of the genus *Hydryphantes.*

LOCALITIES.—This, also, is rather common. I have taken it at Staines and in several localities round London; also in Suffolk and in Kent.

3. *Hydrachna maculifera* Piersig, 1897.

BODY.—Very similar in shape to *H. globosa,* and about same size. Some specimens are very dark in colour. I have taken individuals that were nearly black. In this species the dorsal plates behind the eyes are very small (Fig. 4).

FIG. 4. *M. maculifera.* Dorsal surface.

GENITAL AREA.—Figs. 5 and 6 will show the shape of the genital plates in male and female, the

FIG. 5. Male. FIG. 6. Female.
H. maculifera. Genital plates.

difference being in the outline. Both are covered with a large number of small discs.

LOCALITIES.—This species is not uncommon. I have taken great numbers during this last four years from a pond at Totteridge, north of London, at different seasons.

4. *Hydrachna geographica* Müller, 1776.

BODY.—Shape very similar to the other species of this genus, but when full grown its dimensions are so great that we have no other water mite to compare it with for size. I have found some large species of the genus *Eylais,* but none nearly so big as *H. geographica.* It reaches as much as 8 mm. in length. Koch, in his great work, gives a very good figure of this mite, and so does Müller. It is brilliantly coloured, having vermilion markings on a black ground. Its legs are very bright red, but slightly yellow at the joints. It has no decided dorsal plate, but two chitinous ridges behind the eyes similar to *H. maculifera.* It does not appear necessary to figure this distinct and handsome species.

LOCALITIES.—It is a very uncommon mite. The only place I have taken it, and then not in the perfect state, was in 1895 at Snaresbrook, Epping Forest.

(To be continued.)

TWENTY-SEVEN new members and two honorary members were elected by the Meteorological Society at its last meeting.

RADIOGRAPHY.

By James Quick.

(*Concluded from page* 306.)

MUCH has been said relative to the effects observed upon the skin of the body when it is exposed to the repeated action of X-ray vacuum tubes. That the epidermis is affected more or less severely has been amply demonstrated by the reports of various trustworthy experimenters. Hairs die and fall out, the cells that line the hair follicles perish; and though, as a rule, the hair is regenerated after a time, the effect upon the surviving cells is shown by the weak and stunted appearance of the new growth, also by the fact that it is often white in colour. In the same way the epidermis becomes dry and scaly. The nails are affected, and, briefly, if the vacuum tube is sufficiently close, the nutrition of the nearest and most superficial structures is so impaired that they die and are thrown off. In the worst cases the effect extends more deeply still. Not merely the epidermis, but the corium and even the subcutaneous tissues perish, so that, when the dead structures do separate at last, the destruction may be so great as to necessitate amputation. Not all Röntgen-ray workers are affected, however, and some only under certain conditions of exposure, and when different vacuum tubes are used. It was at first thought that the X-rays were solely responsible for this phenomenon, but results of preceding work were cited showing that similar effects had been obtained by other means than the X-rays—such as prolonged exposure to sunlight or to the electric arc lamp. There appear to be, therefore, some rays emitted in common by the sun, the arc lamp, and the X-ray focus tube, that are thus active in affecting the skin, but which are not necessarily X-rays. This idea is the one held at present by most Röntgen-ray workers, especially in France, Germany, and America.

Although much has been said in these articles about the numerous advantages derived from X-ray investigations, the subject should not be closed without pointing out one or two fallacies that may arise in connection with the work. By shifting a limb up and down and from side to side, the shape of its shadow upon the screen may be distorted so as to resemble a variety of deformities. It is well in all cases of supposed injury to make a routine examination of the correspondingly sound side of the body under exactly similar conditions as to relative position of parts and of the focus tube. It has been pointed out that mistakes may arise from a misinterpretation of the results of a fluorescent-screen observation. In one case an outward dislocation of both bones of the forearm took place in a girl of thirteen. A radiograph taken twelve days after reduction showed a normal position of joint, but an apparent separation of the tip of the olecranon, of which, however, there was no trace to be found on clinical examination. In a second case a radiograph showed what appeared to be a shortening of three inches in a fracture of a femur, whereas the clinical measurements proved there was not more than one inch of shortening. Callus may be pervious to the rays some months after a fracture, and may thus give an impression that union has not taken place, whereas the parts may be firmly united. A fracture without displacement may not show on the radiograph, but may often be recognised when viewed from a fresh aspect. Hence it is well to examine first with a screen, so as to determine the best position for securing a satisfactory result. These cases are rare, but it shows that it is not safe to arrive at a too hasty conclusion.

In reviewing the positions of the general practitioner to-day and at the beginning of 1895, one very clearly sees the enormous strides that have been effected by the introduction of the beautiful methods of X-ray examination. The first aim of a medical man is the alleviation of the sufferings of his fellow-beings, his second is how best to do so with least pain to his patient. Without doubt the X-rays are daily rendering him invaluable aid towards his desired end. They wil continue to do so, and to a wider extent, as improvements in apparatus and better methods of application follow. This is the physicist's responsibility. This fact demonstrates once more the linking of the various sciences, and also the interdependency of one upon another.

In conclusion, I wish to say that it is through the kindness of Messrs. J. J. Griffin & Sons, Limited, of Sardinia Street, London, that the preceding articles of this series have been well illustrated. This firm very willingly permitted me to use all the blocks I selected, and which were taken from their excellently arranged catalogues of scientific instruments. These catalogues will well repay perusal, and a visit to their extensive manufactory proves both interesting and instructive.

I shall be pleased to answer any queries upon practical radiography in the "Physics" columns of Science-Gossip, if such are addressed to the editor. Full name and address of the sender must be enclosed.

Suffolk House,
Dartmouth Park Hill, N.W.

[The Editor of Science-Gossip desires to endorse Mr. Quick's remarks upon the interest in viewing Messrs. Griffin's show rooms; they contain everything new in physical apparatus.]

BOOKS TO READ

NOTICES BY JOHN T. CARRINGTON.

Text-Book of Palaeontology. By KARL A. VON ZITTEL. Translated and Edited by CHARLES R. EASTMAN, Ph.D. Vol. I., ix + 706 pp., $9\frac{1}{4}$ in. × 6 in., illustrated with 1,476 woodcuts. (London and New York: Macmillans, 1900.) 25s. net.

We do not imagine there is any treatise on Palaeontology in the English language comparable with the magnificent work in the German of Professor von Zittel's "Grundzüge der Palaeontologie" and his "Handbuc der Palaeontologie." The book before us is founded on the former. Dr. Eastman—who, by the way, is Assistant in Palaeontology in the Museum of Comparative Zoology at Harvard College, Cambridge, U.S.A.—has not made an exact translation of the "Grundzüge" into English, as, although only completed in 1895, the progress of knowledge has rendered necessary the remodelling of the greater part of the book. In consequence of the translator and editor having submitted various sections to specialists, there is a certain unevenness in the style of the work, which is thus accounted for. Yet from the point of scientific accuracy the result is as perfect as it is possible to obtain. In these alterations Professor von Zittel fully agrees. Thus we have before us the first volume of the most accurate work on fossils that has yet been issued. The list of the editor's collaborators, with their respective subjects, is too long to be given here, as they are a dozen in number, but it suffices to say they are all recognised as authoritative workers in their various divisions. This first volume contains only the invertebrates, and we understand the second volume, which is well forward, will be devoted entirely to the vertebrates. Nearly every page is liberally decorated with illustrations, as may be understood when there are more than double as many figures as there are pages. The drawings, having been well executed as woodcuts, are most excellent, so that we have altogether a remarkable book, and one that every one interested in fossils should make an effort to obtain.

The Witness of Creation. By M. CORDELIA LEIGH. 167 pp., $7\frac{1}{2}$ in. × 5 in., with 18 illustrations. (London: Jarrold & Sons, 1900.) 2s. 6d.

The Hon. Cordelia Leigh has previously launched more than one literary production, but this is clearly an advance on her previous work. This book is largely a reprint of a series of articles written in a magazine. They are intended to help Sunday-school teachers and conductors of Bible classes. The chapters are founded on the Book of Job, and deal with the forces of Nature mentioned there. It is pleasing to find that Miss Leigh has treated her subjects sensibly and with considerable scientific accuracy. This has been verified by reference to several men of scientific repute, who have advised the authoress. It is a book that may be safely quoted by teachers, and one that will interest not only their scholars but also themselves. It is well produced by the publishers and nicely illustrated.

Practical Plane and Solid Geometry. By JOSEPH HARRISON, M.I.M.E., and G. A. BAXANDALL. xii + 557 pp., 7 in. by 5 in., with about 450 figures. (London: Macmillans, 1899.) 4s. 6d.

This is a distinctly good book, and especially useful to the engineering student. It is well written, and the illustrations are clear. Perhaps the earlier portion of the work devoted to plane geometry is rather too brief; but as a whole we can recommend the volume. The general introduction will be useful to the young student, as it contains many hints and instructions that are helpful with regard to the use of instruments.

The Naturalists' Directory for 1900. 152 pp., $7\frac{1}{4}$ in. × 5 in. (London: L. Upcott Gill, 1900.) 1s. 6d. net.

This useful little book is gradually growing larger and more bulky in appearance, and its price is consequently advancing. There are, however, many names still to add, especially of men in the higher ranks in science. It is desirable to make such a work as complete as possible, and we feel sure the editor will gladly avail himself of any future help he may get from our readers by pointing out omissions. His address is 170 Strand, London, W.C.

Elementary Course of Practical Zoology. By the late T. JEFFERY PARKER, D.Sc., F.R.S., and W. N. PARKER, Ph.D. xii + 608 pp., $7\frac{1}{4}$ in. × 5 in., with 156 illustrations. (London and New York: Macmillans, 1900.) 10s. 6d.

Shortly before his death in 1897, Professor Jeffery Parker arranged with his brother, Professor W. N. Parker, of the University of Wales, to produce a practical text-book of elementary zoology for the assistance of students in preparing for public examinations. The result is now before us, having been carried out by the latter author on the plan drafted by the brothers before death separated them. The book is simply arranged, quite effective as an introduction to structural zoology, and so planned as to lead to a future interest in zoology beyond the present instruction to be gained from the treatise.

A Manual of Zoology. By T. JEFFERY PARKER, D.Sc., F.R.S., and WILLIAM A. HASWELL, M.A., D.Sc., F.R.S. xv + 550 pp., $7\frac{1}{4}$ in. × 5 in., with 300 illustrations. (London and New York: Macmillans, 1899.) 10s. 6d.

Owing to the death of Professor Jeffery Parker, the greater labour of producing this work fell upon Professor Haswell. In October 1898 we noticed in these pages the large book on Zoology by these authors, then published as "A Text-Book of Zoology" at thirty-six shillings. The work before us has much the same foundation at a more accessible price. It is very fully illustrated, some of the figures in the text being coloured. The authors have succeeded in producing "A Manual of Zoology" for the use of scholars in better-class schools, and for the junior classes in Universities. The present Manual is intended for the field naturalist as well as for the closet student.

Annual Report of Smithsonian Institute. xxvi + 1021 pp., $9\frac{1}{4}$ in. × 6 in., with 80 plates and 201 illustrations. (Washington: Government Printing Offices, 1899.)

This remarkable production could only be produced by a government or wealthy institution. It really extends only to the 30th of June, 1897, though recently issued. The first 239 pages only are devoted to the report proper, the rest being occupied by

Appendices relating to the administration of the museum, together forming Part I. The second part is devoted to papers describing and illustrating Collections in the United States National Museum. They include "Recent Foraminifera," "Properties of Minerals," and "Classification of Minerals in the U.S. National Museum." The rest of the papers are on Anthropological or Ethnological subjects; they are all interesting and beautifully illustrated.

Life and Happiness. By AUGUSTE MARROTT. 90 pp., 8 in. × 5 in. (London: Kegan Paul, Trench, Trübner, & Co., N.D.) 2*s.* 6*d.*

As the author modestly says in the preface, "you will find nothing strikingly fresh in these pages." They contain a series of elaborated maxims for the guidance of persons for the welfare of body, mind, and conduct. The construction of this book has doubtless been a happy recreation for the author, and he has printed it so that others may share with him in his pleasure.

Kirke's Handbook of Physiology. By W. D. HALLIBURTON, M.D., F.R.S. Sixteenth Edition, xx + 872 pp., 8 in. × 6 in., with 650 coloured and other illustrations. (London: John Murray, 1900.) 14s.

On reference we find that it is less than a year since the fifteenth edition of this valuable and standard work was issued. The fact that another edition is required indicates the importance and necessity of the book to medical practitioners and students. It is not to them only that it appeals, as a better knowledge of the human structure is much needed by the public at large; for, after all, the human frame is a mere mechanical machine to be treated as would any other piece of valuable mechanism. It is therefore desirable in these days of heavy competition that the intelligent owners should have a most accurate knowledge of its economy, so that the best possible use may be obtained during its existence.

The Flowering Plant. By J. R. AINSWORTH DAVIS, M.A., F.C.P. xv + 195 pp., 8 in. × 5½ in. Third Edition, with 70 illustrations. (London: Charles Griffin & Co., Limited, 1900.) 3s. 6d.

The present edition of this work has undergone careful revision, and new illustrations have been added, as has also a chapter on ferns and mosses. Although the latter are, of course, not grouped among flowering plants, the author has found it necessary to give some account of cryptogams. This book might be classed among the better type of primers; and, although so many works of a similar type have already appeared, there is much in this that will help a student of the structure of botany to a better knowledge of the subject. The author is a Professor in the University of Wales, and Examiner in Botany to the Welsh Central Board for Intermediate Education.

The Advance of Knowledge. By W. SEDGEWICK. xi + 227 pp., 8 in. × 5 in., with diagrams. (London: George Allen, 1899.) 6s.

This book is the work of Lieut.-Colonel Sedgewick, late of the Royal Engineers, and shows throughout its pages that professional exactness of expression resulting from a military training in the scientific branch of the Service. It is a thoughtful book, and one that will require careful reading to enable one to fully follow the author's speculations. His chapters are occupied by the consideration of the doctrine of antagonism which prevails throughout Nature, whether material or intellectual; inorganic evolution; the atom; the monad; matter; the ether; and life. Without necessarily agreeing with all the author's speculations, which are indeed in some cases ultra-speculative, this work is well worth examination and is full of suggestiveness; but the reader must be prepared for some high flights of imagination.

Journal of Researches. By CHARLES DARWIN M.A., F.R.S. 492 pp., 8 in. × 5 in., with portrait and 15 illustrations. (London: Ward, Lock, & Co.) 2s.

There is no longer any excuse for not reading the late Charles Darwin's classical journal made during the voyage of H.M.S. "Beagle" round the world. It is now issued in the "Minerva Library" of famous books at the extraordinarily low price of two shillings. The book is prefaced by a biographical introduction. Altogether the present issue of this book may be looked upon with satisfaction.

Object-Lessons in Botany. By EDWARD SNELGROVE, B.A. xiii + 297 pp., 7½ in. × 5 in., with 153 illustrations. (London: Jarrold & Sons.) 3s. 6d.

This book is a manual of structural botany, with numerous pictorial illustrations. We are glad to notice these are taken from familiar plants of easy access. The book does not differ materially from others of its class, but will nevertheless be found useful to teachers and private students. It is Book II. of Mr. Snelgrove's series, being for Standards III., IV., and V.

Experiments on Animals. By STEPHEN PAGET. xii + 274 pp., 7¼ in. × 5 in., with illustrations. (London: T. Fisher Unwin, 1900.) 6s.

So much literature has been injudiciously circulated by well-meaning people upon experiments on living animals it is pleasing to find before us a book dealing with this subject in a commonsense and accurate manner. No one can have a greater abhorrence of inflicting pain than ourselves; but such a mass of inaccurate statements are in existence in print that it was quite time something was written that is not purely sentimental. This work is accompanied by an introduction by Lord Lister. The author has also had the advantage of revision of proofs by several gentlemen of high scientific reputation. This book should be read by both sides—those in favour of experiments on animals, and those of the opposite opinion.

Laboratory Note-Book. By VIVIAN B. LEWES and J. S. S. BRAME. 170 pp. (London: Archibald Constable & Co., 1899.) 4s.

The authors state in the preface that "this 'Note-Book' has been compiled without any reference to any particular syllabus or examination, and is intended to cover such practical work as a student should be familiar with, if he is to have a good groundwork in the subject of Practical Chemistry." The work will, no doubt, prove a useful adjunct to the teacher's demonstrations, and a student who works carefully through should have a good grasp of Elementary Practical Chemistry. Beyond, however, the last twenty or thirty pages, we do not note any advantages which the present work shows over the text-books in everyday use. We are sorry to read of inches (p. 3), grains, and ounces (p. 165), although the first two pages are devoted to an explanation of the Metric System. We cannot help thinking that the instructions (p. 138) to "Dis." a stick of caustic soda in water will lead to a looseness in expression and carelessness in work, which we feel sure Professor Lewes would be the last to countenance.—*H. M. R.*

SCIENCE GOSSIP

THE Board of Agriculture continues to issue illustrated leaflets for the guidance of farmers and fruit-growers. One of the more recent is upon the pear and cherry sawfly, giving particulars of its life-history, depredations, and methods of prevention and remedies.

AT the annual meeting on February 21st of the subscribers to the Millport Marine Biological Station a satisfactory condition of affairs was reported. The station is now in a position to supply zoological laboratories and private students with material for investigation.

WE have received from Messrs. Watkins & Doncaster, of 36 Strand, their new priced catalogue of apparatus, books, and other items necessary to field naturalists. It extends to nearly a hundred pages, and is prefaced by a useful index. A list of books is included in this edition.

SCIENCE has been honoured by Her Majesty through Captain William De Wiveleslie Abney, Director of the Science and Art Department, who has been created a K.C.B., and Major-General Edward Robert Festing, Director of the Science Museum, South Kensington, who has been decorated as a C.B.

MR. WILLIAM TRELEASE has forwarded to us a reprint of a paper read before the Botanical Society of America upon the classification of botanical publications. It will be found useful to those who have a number of pamphlets and other printed records, which in every library are a source of anxiety to their possessors.

WE have received from Mr. W. C. Hughes, of Brewster House, 82 Mortimer Road, London, N., an interesting bundle of circulars, and his recent catalogue of lanterns and dissolving-view apparatus. There are also lists of new films for ordinary lantern work and animated pictures. Mr. Hughes will supply, on application, these lists to those interested in lantern work.

MR. ONSLOW FORD'S marble statue of the late Professor Huxley is to be unveiled in the central hall of the Natural History Museum at Cromwell Road, Kensington, on April 28th. The Prince of Wales will then formally accept in person the memorial on behalf of the trustees of the British Museum. Sir Joseph Hooker will deliver the address on the occasion.

THE President for the next meeting of the British Association will be Professor Rücker, M.A., D.Sc., F.R.S. Dr. Rücker stands in the first rank of physicists. He was educated at Clapham Grammar School and Brasenose College, Oxford. He was appointed Professor of Mathematics and Physics at the Yorkshire College in 1874; became a Fellow of the University of London, 1890; was Royal Medallist of the Royal Society, 1891; Treasurer of the British Association, 1891 to 1898, and Trustee, 1898. He was President of the Physical Society, 1893 to 1895, and was appointed Secretary of the Royal Society, 1896. Professor Rücker is the representative of the Royal Society on the Governing Body of Rugby School, and a member of the Board of Visitors of the Royal Observatory, Greenwich.

MR. WILLIAM E. HOYLE, M.A., and Miss Clara Nördlinger have done wisely in reprinting from the "Library Association Record" their paper upon the "Concilium Bibliographicum at Zurich and its Work," as the Institution cannot be too widely known and understood. The reprint is issued for private distribution; but we do not imagine there would be much difficulty in seeing the copy if application were made to the authors at the Museum, Owens College, Manchester.

BULLETIN number 22, New Series of the Division of Entomology in the United States Department of Agriculture, is to hand. It contains upwards of one hundred pages of first-class work on economic entomology, accompanied by a number of carefully drawn illustrations. A curious record is made by Dr. Blanton of Greenville, Miss., to the effect that a praying mantis, *Stagmomantis carolina*, is often found in his apiary feeding upon the bees. They are stated to kill them as ravenously as a cat would mice.

IN Bulletin 22 of the United States Division of Entomology is a report received from Dr. H. M. Smith, of the United States Fish Commission, in which he states that Captain John Baxter, of the United States tender "Haze," had at times sailed through twenty miles of dead may-flies in the middle of Lake Erie. Dr. Smith further reports that he found on the flat top of a gas-buoy a mass of may-flies covering the entire surface full two to four inches thick.

WE have received a reprint of an interesting paper read before the Koninklijke Akademie van Wetenschappen, of Amsterdam, upon a case of an apple within an apple, found by Miss T. Tammes at Groningen. In her paper this lady gives an account of this curious "sport," and a figure of a vertical section showing one complete fruit within another. The lady has evidently examined the previous history of such cases, as she quotes a number of similar instances in other fruits, and Dr. Maxwell T. Masters's experience of other cases.

MANY of our readers will have doubtless been interested in the scientific work accomplished at the Blue Hill Meteorological Observatory, U.S.A., in high altitudes of the atmosphere with the aid of box kites. We understand from Messrs. James Pain & Sons, of 121 Walworth Road, London, S.E., that they have been appointed sole agents in this country for these kites. Independently of their scientific value they will be found of much interest in kite-flying, which promises to become a fashionable amusement in Britain. A string of tandem kites was flown on March 3rd, last year, to an altitude of 12,507 feet.

THE ninth annual Report of the Society for the Protection of Birds is to hand. The Society numbers no less than 22,000 members. The balance-sheet appears to be satisfactory, showing upwards of 100*l*. on the right side. The work of the Society is not confined to these islands, as it has branches in Australia and New Zealand. It is evident from the Report that the Secretary and Organising Committee are active, and we believe that the influence of the Society for the Protection of Birds is for good and very widespread. The London offices are at 3 Hanover Square, W.

IN MEMORIAM

EMILE BLANCHARD.—One of the earliest names we remember in connection with our studies in zoology was that of the French entomologist, Emile Blanchard. He commenced the work of a professional naturalist as an attendant in the Paris Museum, but he rose through terrible affliction to be the most esteemed member of the scientific staff. He was stricken with total blindness at the age of fifty, and later by total deafness. In his lonely life that followed how severe must have been the repining! He was a member of the French Academy of Sciences. In 1844 Blanchard was appointed Professor of Entomology to the Paris Museum. Much of his entomological work was occupied with the Coleoptera. He died on February 11th last, at the age of eighty-four years.

J. F. HODGES.—We learn from the "Irish Naturalist" that one of the prominent Belfast men of science has passed away at the age of eighty-four years. Professor Hodges was educated for the medical profession in Dublin and Glasgow, and took the degree of M.D. in the University of Giessen. He was under Baron von Liebig as a student of agricultural chemistry. On his return to Ireland Mr. Hodges was appointed Professor of Chemistry at the old Belfast College, and later to the Professorships of Agricultural Chemistry and Medical Jurisprudence in Queen's College, Belfast, both of which Chairs he held up to the time of his death. He was for many years Government Analyst; he also held the appointment of Public Analyst for the City of Belfast and five adjoining counties. Professor Hodges wrote chiefly on agricultural chemistry, his books being well known.

EDWARD JOSEPH LOWE.—Well known for the handsome books on ferns and flowering plants, Dr. E. J. Lowe, F.R.S., died on March 10th, at Shirenewton Hall, near Chepstow. Dr. Lowe was a remarkable man, of strong character, and one who devoted much attention to scientific matters. His last book on the hybridisation of ferns showed how painstaking was his work. In addition to his botanical investigations Dr. Lowe was an eminent meteorologist, having begun his records of climatology so long ago as 1840. He published several works on this science, one being "The Climate of Nottinghamshire." He also issued Barometrical Tables in 1857, "Weather Prognostics," and "The Natural Phenomena of the Seasons," the latter referring to unusual conditions of various seasons during about sixteen hundred years. He also wrote on luminous meteors for the British Association. In collaboration with Professor Edward Forbes, he was one of the writers of their "British Mollusca." He was a F.R.S. and an original and life member of the Meteorological Society. Dr. Lowe was born in November, 1825, at Nottingham. His conservatories at Shirenewton Hall almost aspired to the rank of biological laboratories, as his arrangements were conducted with every reference to scientific requirements, every detail being recorded with utmost care.

METEOROLOGICAL

GEORGE JAMES SYMONS.—The science of meteorology in this country is not so well equipped with workers that it can afford to lose one of the most systematic in Europe. Born in Pimlico on August 6th, 1838, Mr. Symons died on March 10th last, from the effects of a stroke of paralysis, which he suffered about a month previously. From his youth upwards he took an acute interest in clouds and weather results, and eventually became the recognised leader of meteorological science in Britain. When a young man Symons got an appointment in the Meteorological Department of the Board of Trade, which he held for several years under the late Admiral FitzRoy. He then began to systematically collect rainfall statistics, which occupied most of his attention to the end of his life. This undertaking grew to be one of great magnitude, his later records dealing with nearly 3,500 stations. Considering the economic value of these records, it is surprising they did not receive greater public recognition. As it is, however, they have proved to be of immense use to sanitarians and engineers when dealing with town water-supply in this country; and he frequently appeared as technical witness or adviser on the subject before Parliamentary Committees and elsewhere. In 1866 he published "Symons's Monthly Meteorological Magazine." That periodical has continued ever since in the form of a small monthly octavo, the series containing a mass of valuable information. Mr. Symons received much honour in the world of science. He was a Fellow of the Royal Society; of the Royal Meteorological Society from 1856, and served on its Council from 1863, was its president in 1880, and was again elected President for the Jubilee of the Society this year. The latter Society owed much of its present prosperity to his energy and common-sense advice at its Council meetings. He was also an active member of the British Association for the Advancement of Science, and a member for several years of the Council of the Royal Botanic Society of London, and held similar office in the Sanitary Institute. He was a Medallist of the Society of Arts, having been awarded the Albert Medal in 1897. We hear with pleasure that his great work is to be continued—we understand, under the guidance of his colleague, Mr. H. Sowerby Wallis. On the various occasions when we have met Mr. Symons, we have always left him with a sensation of pleasure, and of having learned something from his conversation.

CLIMATE OF SOUTH ESSEX.—After my recent illness I stayed for a time at Brighton; but, not making the progress desired, my doctor suggested a sojourn at Southend-on-Sea, which possesses one of the driest and most equable winter climates within easy reach of London. In the Shrubbery on the cliffs facing, with southerly aspect, the estuary of the Thames, the winter heliotrope, or scented coltsfoot (*Petasites fragrans*), flowered profusely throughout January. There is there a vigorous myrtle bush of some six feet in diameter, bearing fruit. Some of the Japanese euonymus bushes also bear fruit. This is uncommon in England.—*John T. Carrington.*

MICROSCOPY

CONDUCTED BY F. SHILLINGTON SCALES, F.R.M.S.

GREGARINIDAE.—A writer in the "Journal of Applied Microscopy" has a useful and practical note on how to obtain and keep Gregarinidae. He calls attention to the inadequate instructions given in most text-books on matters of this sort, directions such as, "Take a drop of water containing amoebae," &c., reminding one of the reputed old cookery-book instruction: "First catch your hare." Gregarinidae may be found, however, according to this writer, "more or less abundantly, usually less so when you come to look for them, in the intestines of insects and of other invertebrates. But in the alimentary canal of the yellow-jointed larvae of *Tenebrio molitor* they may be found at all times, and in abundance. This is the black beetle found in granaries, mills, barns, &c. Its larvae, commonly known as meal-worms, and often erroneously called wire-worms, may be found in abundance in flouring mills, feed-stores, under boards and bags that have lain for several months, or under feed-boxes in stables—anywhere, in fact, where ground grain is stored. The best time is when repairs are being made in a neighbouring mill." The larvae may be kept for an indefinite time, without further attention, by simply placing them in glass or stone jars with plenty of the grain débris in which they are found, occasionally adding more meal, dry-rotten wood or rags. At certain times of the year they are apt to metamorphose rapidly if too well fed, and by keeping the jar covered the beetles depositing eggs produce a new brood, but this is likely to deplete the stock. "To find the Gregarinidae for demonstration or study, snip off with small scissors both ends of a larva, seize the protruding (white) intestine with forceps, draw it out, and tease a portion in normal salt solution (water will do) on a slide. Cover, find with the low-power minute, oblong, transparent bodies, and study with any higher objective to suit." The writer adds: "The larvae, by the way, serve another purpose; they are used for feeding certain birds or chameleons, &c., so that in large cities they may be found for sale at bird stores."

AMOS TOPPING.—There is scarcely an amateur microscopist who is not acquainted with the name of Amos Topping, or who does not possess some of the objects prepared by him. The news of his death, which took place on February 25th, was received with deep regret. Although he was sixty-nine years old, he carried his age well, and had the heart and manners of a young man. His genial disposition, sympathetic nature, and even temper gained for him warm friends wherever he went. He may be said to have died in harness. It was his rule to call upon London opticians, with whom he did business, every week; and so recently as February 22nd, three days before his death, he paid his usual visits and seemed to be in his ordinary state of health. His death was due to syncope, and was quite sudden and unexpected. His life had been entirely devoted to microscopical work. Mr. Topping's father enjoyed a high reputation in his day for his preparations for the microscope, and the son began to take part in the work at the early age of twelve years. For a period of fifty-seven years he has sent forth to the world objects of exquisite beauty, much above the average in their freedom from imperfection, and all characterised by great care and neat finish. In every department of his work he was extremely successful, but he has always been noted for one particular slide, and that is the proboscis of the blow-fly. No other preparer has succeeded in so mounting this subject as to render it sufficiently flat for use as a test-object; and unless some other worker knows the secret, it is likely to become one of the lost arts, and, as we at present know it, a rarity. Mr. Topping was always a little reticent regarding his method of preparing this object, and if he were asked whether he would mind saying how it was done, he promptly replied "With pleasure, sir," and proceeded as follows: "I put a piece of sugar upon my bench and hold a blow-fly very closely to it; directly he puts out his proboscis to touch the sugar, I just snip off the tongue with a pair of scissors I keep handy for the purpose, and straightway mount it." With the death of Mr. Topping one of the links with the early days of practical microscopy is broken, and the whole microscopical world is the richer for his years of hard work and the poorer by his death. He leaves a widow, who was helpmeet, not only in his domestic life, but in his business labours, for forty-six years. He leaves also three daughters.—*Fred. W. Watson Baker*, 313 High Holborn, London.

HABIT OF AMUSEMENT IN ROTIFERS.—Under this heading in a recent number of the "New York Journal of Popular Science," a note by Mr. James Weir, jun., M.D., describes *inter alia* a rotifer which he has named *Melicerta copeii* found in Tennessee. This rotifer must be more highly developed intellectually than the effete organisms of the Old World, as Dr. Weir has plainly observed it in its "moments of relaxation, during which it engages in sports and pastimes." Its residence is a conical tube, which it leaves only "when on pleasure bent." In fact, says Dr. Weir, "I am convinced that it never leaves home unless in search of pleasure. Several of these little animals will meet in a still pool and immediately begin a game of 'tag' or 'hide-and-go-seek.'" Then follows a vivid description of the game as played by these exceptionally interesting animals, until one almost wishes one were a boy again, or better still a rotifer. Mr. Weir's observations, however, extend still further, and he has observed in the eyes of *Melicerta* an arrangement of cells in the retina analogous to the rods and cones of the human retina. Dr. Weir rightly considers this "unique and very wonderful." He goes on, "When playing 'tag' this minute animal is directed in the pursuit of its fleeing playmate by sight, and not by another and analogous sense. While at play one of these little creatures will hide behind a small pebble or bit of alga; when one of its playmates approaches, it will suddenly dart out upon the unsuspecting passer-by and greatly startle it. Their actions are so evidently innocent sport that the most casual and obtuse observer cannot mistake them for anything else." After this remark we accept with gratitude the further statement, "When we take into consideration the fact that this animalcule is almost microscopic in size, and that it is of very low organisation, this habit of amusement seems very wonderful indeed."

Public Opinion.

Price Twopence.

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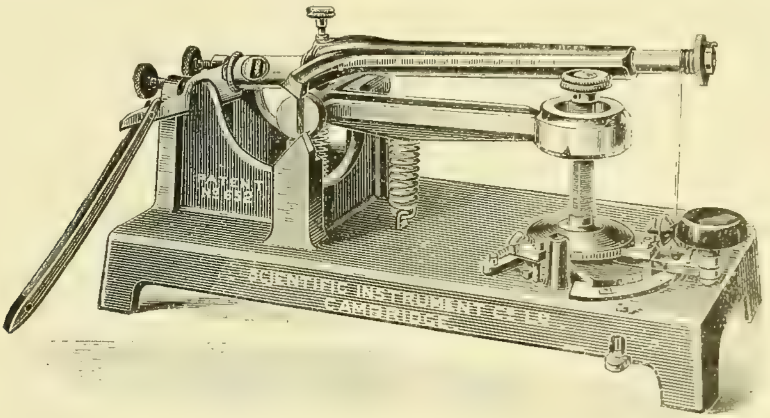
This interesting note called forth in the "English Mechanic" the following letter, signed "C. F. R.," in which initials it is not difficult to recognise a well-known authority on rotifers:—"Dr. Weir's note on the remarkable sportive habits of *Melicerta* might be supplemented with other more wondrous feats of this wonderful rotiferon. Any one who has seen this helpless, awkwardly swimming creature when it has had the misfortune to become detached and to be driven out of its tube will be much interested to hear that it can dart about in and out of its house, hide behind grains of sand with one eye over the edge or round the corner, and do other frisky gambols. Dr. Weir might well have added that, with a little perseverance and a grain or two of imagination, *Melicerta* can be seen to use its foot as a prehensile organ; in fact, like an elephant his nasal trunk. When a small rotifer of the genus *Rattulus* or *Mastigocerca* comes by, *Melicerta* will seize it, break off its long pointed toe, and use it as a toothpick to clean its teeth, of which it has quite a number, quietly sitting the while on the above-mentioned grain of sand. The eyesight of *Melicerta*, with its vertebrate retina of rods and cones, is so powerful that it often tries to look at the observer through the other end of his (the observer's own) microscope, and, no doubt, succeeds. A wonderful creature is *Melicerta*, and, in order to observe all these and other marvellous habits, a good microscope and a little imagination only are required, such as Dr. Weir seems to possess in so high a degree."

Extracting Air from Microscope Objects.—The following note, extracted from the "Optician," may interest some of our readers:—One often finds, after killing and hardening any small animal, that some part of it, commonly the intestine, contains air-bubbles. Also, in decalcifying small calcareous animals with acids, especially when one hurries the process, bubbles of CO_2 are not infrequently formed. At all events, whatever the origin of the bubbles, their presence is adverse to obtaining perfect sections and series. Such bubbles of gas can be readily removed by the following process, due to Professor E. W. Berger, of the Johns Hopkins University, U.S.A. It is well known that water contains a considerable quantity of air and some other gases in solution, and that these can be removed by boiling the water. Boil therefore, for a short time, several hundred cc. of water, and while this is still quite hot pour it into a bottle with a tightly fitting stopper, leaving little or no air between the water and the stopper. When the water has become cooled to a lukewarm temperature, place the objects in question into the water and cork the bottle tightly as before. After several hours (two or three to twenty-four hours) the water will have absorbed all the gas, and the object will have settled to the bottom. Should the object still contain gas, repeat the operation. Should one fear that the object may suffer injury, normal salt solution, or alcohol, might be suggested. Unfortunately, however, alcohol contains but little gas in solution.

New Cambridge Rocking Microtome.—The Cambridge Scientific Company have recently brought out a new and improved pattern of their well-known rocking microtome. The earlier instrument was introduced as far back as 1885, and has made its way into colleges and laboratories throughout the world. It is undoubtedly the simplest, cheapest, and most efficient microtome for the cutting of serial sections. It is unnecessary for us to describe the principle of this microtome, as we have already noticed the instrument (Science-Gossip N.S., vol. ii. page 228); but the improvements introduced in the new model are increased rigidity, impossibility of making sections in the upward movement, or of cutting thick and thin sections, graduated arc for showing the thickness of the sections, catch for holding the object above the razor edge, improved method of fixing the cord, and new object-holder. The first three of these improvements appear to us to be the most important, and to have been successfully accomplished. The price of the microtome is slightly higher than hitherto, being £4 10*s.*, without razor and object-holder. There is one drawback to the use of a microtome of this type, and that is that the cut surfaces have necessarily a slight curve on them. In most cases this may be ignored, but it is as well to mention here that another pattern is made by the same firm, at a rather higher price, by which entirely flat sections are cut. Beginners may perhaps be reminded that a rocking microtome is useful mainly for cutting long "ribbons" of sections such as are used in biological and other laboratories.



New Cambridge Rocking Microtome.

MICROSCOPY FOR BEGINNERS.

By F. Shillington Scales, F.R.M.S.

(*Continued from page* 314.)

THE cone of light transmitted by the condenser should approximate to that of the objective; but few objectives will stand solid cones of light equal to their own apertures. If the worker is using the Abbé illuminator of 1·2 N.A., he will, of course, only obtain a total aperture of 1 N.A., unless the condenser is in immersion contact with the under side of the slide. Theoretically, therefore, this condenser is suitable for lenses of 1 N.A. and even more, and suitable also for lenses of lower apertures by the simple process of stopping the aperture down by means of the iris or other diaphragm. The worker soon becomes expert in the use of the iris diaphragm; but we would caution beginners against the too prevalent tendency to cut off an unnecessary portion of the marginal rays in order to secure contrast in the image. By so doing, the latter suffers rather than gains, diffraction images being set up. As a matter of fact, the diaphragm should be closed gently and cautiously, just enough to slightly accentuate the image and no more; and it will generally be found that, under these circumstances, if the eye-piece be removed, the back of the objective, examined down the empty tube, is found to be from $\frac{2}{3}$ to $\frac{3}{4}$ filled with light. A good objective should stand satisfactorily what is accordingly often spoken of as a $\frac{3}{4}$ cone of illumination.

In most cases strictly axial, *i.e.* central, illumination is used; but there are certain cases, such, for instance, as the structure of diatoms, for which oblique illumination is necessary. Formerly this was obtained by swinging the mirror, or mirror and condenser combined, slightly to one side, but more generally now by the insertion of a stop in the carrier beneath the condenser. In this stop a narrow slot has been cut, or a segment cut out. The effect of this is to throw an oblique beam of light in one direction across or down the diatom, according to arrangement, and thus to bring into greater prominence shadows of the fine striae otherwise almost invisible, owing to their exceeding minuteness. To do this properly requires considerable practice and experience, as may be readily understood when we remember that the "markings" in *Amphipleura pellucida* exceed 90,000 to the inch.

We have alluded to the necessity of making sure beforehand that the mirror and tail-rod are truly in line with the optic axis of the microscope. If this be not the case, the image of the lamp flame will appear to shift in position as the tube of the microscope is racked up and down. It is necessary, in addition, that the condenser itself shall be truly centered with the objective. Microscopes fitted with a simple sub-stage ring are only approximately centered, but the mounting of the condenser is generally slightly elliptical, and by rotating the condenser an approximately central position can generally be obtained. The value of a proper centering sub-stage is now evident, and the simplest way of centering the condenser is to make a minute ink-spot in the centre of the top lens, and centre accordingly, afterwards wiping the ink-spot off. Some few condensers were formerly fitted with a small brass perforated cap for this purpose. Another method is to focus the image of the iris diaphragm when practically closed, and centre accordingly; but a little practice enables the microscopist to centre his condenser without any of these aids.

It may be advisable here to mention that almost all objectives differ in the centering of their mounts, and therefore with high-power work the centering of the condenser will vary for each objective. A rotating nose-piece also disturbs the centering of the objectives, and consequently of the condenser, as no nose-piece is constructed with sufficient accuracy to ensure absolute truth in this respect.

We think we have now made plain the principle which underlies the use of the condenser, and which amounts really to this—that the light and image rays must coincide. If the condenser be adjusted so that its focus be *beyond* or *below* the object on the stage, the rays of light will not coincide with the focus of the objective, but will cross, and the result will be an imperfect image.

There is one other point that may be mentioned in connection with the focussing of the condenser. So far, we have purposely assumed that the source of light has been that of a lamp, which gives practically parallel light. In "Carpenter on the Microscope" it is rightly pointed out that ordinary daylight, owing to its diffusion, does not give parallel light, though a window acts to some extent as a limiting diaphragm. The focus of the condenser differs somewhat, therefore, for lamplight and for daylight.

We have already alluded to the use of oblique illumination by means of suitable spots placed beneath the condenser in a carrier adapted for that purpose. There is another form of illumination generally spoken of as "dark-ground illumination." In this case a small central spot, supported on arms, occupies a similar position, and by cutting off those central rays of light which would otherwise enter the objective gives an absolutely dark field in the microscope. When a suitable object is interposed on the stage, however, the annular rays of light that would otherwise escape the objective are intercepted by the object, and thus diffracted into view. The result is often singularly beautiful—diatoms, foraminifera, and transparent zoophytes being exhibited shining upon an otherwise dark and contrasting background. To obtain the best results it is necessary to bear in mind that the diameter of the stop must be proportioned to the aperture of the objective. Thus a low-powered, and presumably low-apertured, lens will require a small stop, whilst a high-powered and high-apertured lens will require a much larger stop. It would not be of much advantage if we were to give means of ascertaining the size of stop required; if necessary, an experimental stop can readily be constructed out of blackened cardboard. The condenser will also require a certain amount of adjustment; and a Davis shutter, which is a small iris diaphragm fitted *above* the objective, by its facility for reducing the aperture of the objective, enables one to obtain perfect background illumination. The spot lens and parabolic illuminator are now but little used. The value of this means of illumination for really critical work we need not discuss here.

Before leaving the subject of oblique illumination we may just mention that the mere slight tilting of the mirror will often greatly increase the resolution of difficult objects.

(*To be continued.*)

MICROSCOPY.—Other articles on subjects connected with Microscopy will be found in this number at pages 325 and 337.

NOTES & QUERIES

HUMMING-BIRD HAWKMOTH.—A lively specimen of *Macroglossa stellatarum* was taken on February 20 in a shop in the village of Lynmouth, North Devon. It seems rather early for this species to emerge from hibernation; this is especially the case as the weather had been very cold.—*Thomas H. Briggs, Rock House, Lynmouth.*

PLOVERS FLYING AT NIGHT.—I do not know whether it is a usual occurrence, but in the fields opposite this house, during the bright moonlight on Saturday, March 10, the peewits were flying and uttering their plaintive cry at 8 P.M. It is the first time I have heard them so late at night.—(*Rev.*) *R. Ashington Bullen, Axeland, near Horley, Surrey.*

[We have often seen plovers flying at night when moonlight, whilst returning from entomological excursions in Yorkshire. We have frequently been followed by these birds for more than a mile, as late as midnight, when crossing a piece of marshy ground. They then uttered their cries as vigorously as in daylight.—ED. *S.-G.*]

LOCALITIES FOR LAND-SHELLS.—We have received from Mr. R. Welch, of Belfast, the first of a series of photographs which that gentleman proposes to take of the more important localities for land-shells in Ireland. Mr. Welch's fine photographic work is so well known that we feel sure many of our readers interested in malacology would be glad to have such a series to compare with the habitats with which they are familiar.

PETROLOGY.—Could any one kindly check some of my petrological observations, and give some other information of a kindred nature? I have several good books on the subject by Harker, Rutley, Cole, and others; also some thirty typical slides and a Dick microscope. My profession does not give me opportunity to join societies and attend meetings to find out if I am proceeding correctly. I am anxious to meet with a correspondent who will look over my mineral slides, and tell me if my own determinations are correct. I should also like the titles of any journals or proceedings of societies which might assist me.—(*Lieut.*) *D. St. A. P. Weston, R.N., R.N. Gunnery School, Sheerness.*

AN EMU OMELETTE.—A luncheon, which every one present agreed would have delighted the heart of the late Frank Buckland, was given on February 27th by Mr. Henry Stevens, of great auk fame. The entertainment, which was held at the Camera Club—for Mr. Stevens is perhaps as well known as a leading amateur photographer as he is in the capacity of an auctioneer where natural history is concerned—was primarily intended to do justice to an "emu's egg omelette," made from an egg laid in England on Sir Cuthbert Peek's estate in Dorsetshire. The bird, strange to say, is certainly thirty-five and most likely approaching fifty years of age. The *menu* on the auspicious occasion included, among other delicacies more usual in this country, kangaroos' tails and a saddle of reindeer. The writer, who was one of the eight guests, can speak from personal observation—or, one should say, by experiment—that kangaroos' tails were excellent; the reindeer was like mutton somewhat in taste, but with a beef-like grain and a suspicion of flavour approaching that characteristic of hare. With regard to the omelette successfully contrived by the Club's *chef*, after the egg had been opened at table, it must be said that the majority, if not all, of those present indulged in a second helping. Perhaps the greatest fun during the afternoon was experienced while Mr. Stevens was dexterously sawing off the top of the egg, for the shell is to be mounted on silver as a memento of the occasion. The side dishes and ornaments of the table included eggs of all kinds: snails' eggs, crocodile eggs, alligators' eggs, etc. Very interesting, to make special mention, was the most perfect example of a great auk's egg that has yet been placed in Mr. Stevens's hands, and which may probably realise £400, to judge from the bidding at the sale of the last specimen sold in the Rooms at Covent Garden. To return to the emu's egg: it weighed two pounds, and the yolk, as it lay in a soup-plate, was over four inches across. We must not forget, too, that Her Majesty's health was drunk in a magnum of 1851 port, which Mr. Stevens brought from the King Street cellar for the occasion, and that it was found to be in prime condition.—*Wilfred Mark Webb, 2 Broadway, Hammersmith.*

COLLECTION OF COLEOPTERA.—I have a collection of about 900 Coleoptera, the majority of which I have obtained by exchanges. They are mounted on cards of all shapes and sizes, most of the cards being no larger than the beetles themselves; consequently they have a very untidy appearance. I wish to remount them for the cabinet. What I have mounted I have put on cards of one size for each species, the beetle being gummed in the centre, and its name written at the bottom. They look very well arranged like this; but I do not know whether it is the correct method. I shall be much obliged for any instructions you or your readers can give through your columns. What is the best modern handbook to the British Coleoptera, costing up to, say, a sovereign? I should like to see a monograph on beetles running through SCIENCE-GOSSIP on the lines of the Butterflies now appearing. Is there any probability of this occurring?—*Thos. W. Witshaw, Sheffield, March* 1900.

GEOLOGISTS' ASSOCIATION OF LONDON.—In the course of a paper on Wind-worn Stones, read before the Geologists' Association on March 2, by Mr. F. A. Bather, M.A., F.G.S., the author gave an epitome of the various theories that have been put forward to account for the characteristic features of certain more or less pyramidal stones with peculiarly polished surfaces, met with in various parts of the world. He stated the reasons for believing that in most cases these characters are due to the action of wind-blown sand. He compared such stones with certain examples found in the British Islands. One specimen in particular was a stone found by Mr. R. D. Darbishire in a drift deposit at Bowdon (Cheshire), but derived from the Bunter Pebble Beds. This stone was a good example of the three-sided pyramidal form known as the "dreikanter" type. Mr. Bather believed that the reason why so few examples were known from geological deposits was that the characters of such stones were not sufficiently well known to geologists, and he appealed to workers in the field to pay more attention to the subject, which might be the means of throwing considerable light on former geological conditions.—*Percy Emary, 12 Alwyne Square, Canonbury, London, N.*

CONDUCTED BY F. C. DENNETT.

1900. Apr.	Rises. h.m.	Sets. h.m.	Position at Noon. R.A. h.m.	Dec ° ′
Sun .. 10	5.18 a.m.	6.45 p.m.	1.14	7.53 N.
20	4.56	7.2	1.51	11.27
30	4.36	7.18	2.29	14.43

Apr.	Rises. h.m.	Souths. h.m.	Sets h.m.	Age at Noon. d. h. m.
Moon 10	2.[illegible]3 p.m.	9.5 p.m.	3.15 a.m	10 15 30
20	0.2 a.m.	4.5 a.m.	8.12 a.m.	20 15 30
30	5.2 a.m.	1.7 p.m.	9.23 p.m.	1 6 37

	Mar.	Souths. h.m.	Semi-Diameter.	Position at Noon. R.A. h.m.	Dec. ° ′
Mercury	10	10.37 a.m.	4.9″	23.50	1.57 S.
	20	10.22 a.m.	4.0″	0.14	1.5
	30	10.24 a.m.	3.4″	0 56	2.53
Venus	10	2 56 p.m.	9.8″	4.9	23.40 N.
	20	3.2 p.m.	10.8″	4.54	25.43
	30	3.6 p.m.	12 0″	5.38	26.47
Mars	20	10.44 a.m.	2.1″	0.37	2.57 N.
Jupiter	20	2 43 a.m	20.0″	16.34	21.3 S.
Saturn	20	4.30 a.m.	8.0″	18.22	22.20 S.
Uranus	20	2.51 a.m.	1.7″	16.42	22.12 S.
Neptune	20	3.52 p.m.	1.2″	5.37	22.8 N.

MOON'S PHASES.

		h.m.			h.m.
1st Qr.	Apr. 6	8.55 p.m.	*Full*	Apr. 15	1.2 a.m.
3rd Qr.	,, 22	2 33 p.m.	*New*	,, 29	5.23 a.m.

In apogee April 11th at 10 a.m.; and in perigee on 27th at 5 a.m.

METEORS.

			h.m.	
Apr. 17 25	β Serpentids	Radiant R.A.	15.24	Dec. 17° N.
,, 17–20	Lyrids	,, ,,	18.0	,, 32° N.
,, 29-May 6	η Aquarids*	,, ,,	22.28	,, 2° S.

* To be looked for just before sunrise.

CONJUNCTIONS OF PLANETS WITH THE MOON.

				° ′
Apr. 3	Venus†	1 a.m.	planet	0.46 N.
,, 18	Jupiter*†	5 p.m.	,,	1.3 N.
,, 20	Saturn*†	3 p.m.	,,	1.3 S.
,, 27	Mercury*	1 p.m	,,	7.53 S.
,, 27	Mars*†	7 p.m.	,,	5.29 S.

* Daylight. † Below English horizon.

OCCULTATIONS AND NEAR APPROACHES.

Apr.	Star.	Magnitude.	Disappears. h.m.	Angle from Vertex. °	Reappears. h.m.	Angle from Vertex. °
4	σ Tauri	4 8	9.30 p.m.	29	10.22 p.m.	263
6	ν Geminorum	4.0	1.6 a.m.	157	Near approach	
8	η Cancri	4.3	11.46 p.m.	53	12.45 p.m.	277
17	δ Scorpii	2.5	10.45 p.m.	224	Near approach	
21	ξ^2 Sagittarii	3.5	2.27 a.m.	110	3.42 a.m.	267
24	c^1 Capricorni	5.2	3.23 a.m.	45	3.57 a.m.	337

THE SUN has again been exerting considerable energy. On March 9th two fine spots were seen advancing towards the limb. No trace of them was seen four days previously.

MERCURY is a morning star all the month, in Pisces, reaching its greatest western elongation, 27° 19′, at 3 a.m. on April 22nd, but badly placed for observation, rising only about half an hour before the sun.

VENUS is an evening star, in good position all the month. It is in Taurus, and at midnight on April 28th reaches its greatest elongation, 45° 30′ east. The planet cannot well be better placed, not setting until about four and a half hours after the sun.

MARS is too close to the sun for observation.

JUPITER rises nearly a quarter of an hour before midnight on the 1st, and two hours earlier on April 30th.

SATURN rises about two hours later than Jupiter. Both are too far south for very successful observation.

URANUS is very near to Jupiter, coming to the meridian only a few minutes later than that planet, and situated just over a degree farther to the south.

NEPTUNE at the end of the month will be found about four and a half degrees to the south of Venus.

GIACOBINI'S COMET (*a* 1900) is estimated by M. Javelle to be equal to 13th magnitude, and therefore is out of the reach of small instruments. On the afternoon of April 28th it will be in perihelion.

THE ISAAC NEWTON STUDENTSHIP, at Cambridge University, of the annual value of £200, for three years, has been awarded to J. Hopwood Jeans, B.A., of Trinity College.

APPARENT ENLARGEMENT OF CELESTIAL OBJECTS NEAR THE HORIZON is a subject which from time to time causes much correspondence. A paper from Mr. J. D. Hardy and a note from Rev. Joseph Allen were read on the subject at the meeting of the British Astronomical Association on February 28th, and led to considerable discussion. No very definite conclusions, however, have been reached.

DR. KARL THEODOR LUTHER has just passed away in his seventy-eighth year. So far back as 1834 he was elected an Associate of the Royal Astronomical Society. On April 17th, 1852, Dr. Luther discovered, at Bilk, the 17th minor planet, Thetis. This was but the first of some four-and-twenty of these bodies; he likewise calculated the orbits of many others. For a long time he had been Director of the Düsseldorf Observatory.

PROFESSOR PIAZZI SMYTH, son of the late Admiral W. H. Smyth, has also died. Previous to his resignation in 1888, he was for many years Astronomer Royal for Scotland, and once made an expedition to Teneriffe to observe the celestial objects under more favourable atmospheric conditions. A popular account of this visit is given in his book on "Teneriffe," illustrated by stereoscopic views. He was well known as holding most singular views respecting the Great Pyramid, which were given to the world in "Our Inheritance in the Great Pyramid" in 1864. The late R. A. Proctor, in 1884, ruthlessly shattered his contentions.

THE TOTAL ECLIPSE OF THE SUN.—We are sorry to hear that there is danger of the British Astronomical Association expedition to Portugal, Spain, and Algiers falling through, only two-thirds of the requisite number having booked their passage. It had been hoped that the Royal Mail Steamship *Tagus* would have conveyed the party to Oporto, Alicante, or Algiers, and afterwards collected the members and brought them home. Those who remained on the Portuguese coast would have the greatest chance of disappointment. An effort will be made by Mr. Nevil Maskelyne to obtain a kinematographic record of the eclipse from an American station. We trust that on this occasion the attempt will prove successful.

PHYSICS

CONDUCTED BY JAMES QUICK.

SEAT OF THE E.M.F. IN A VOLTAIC CELL. This formed the subject of the presidential address recently given by Professor Oliver J. Lodge to the Physical Society. He said :—"Strange that a discovery of this magnitude, and I may say also, in one sense, of this simplicity, should have been associated with a controversy which, arising in one form almost directly it was announced, has continued, with slight modifications and with temporary lulls, yet really without cessation, throughout the whole century. I hardly know of another instance of a question to which every physicist in the world must necessarily at some time or another have given his attention remaining so long unsettled. What is the seat of the chief electromotive force in the voltaic pile?" Professor Lodge then discussed the controversy from the contact and the chemical sides. The opposing sides of the old controversy used to be called "contact theorists" and "chemical theorists." Now the opposite sides are involved both in contact and both in chemical views. It is a question of which of several contacts is the effective one, and what kind of chemical action or affinity is the active cause. Is it the contact and chemical affinity across the metal-metal junctions or across the metal-air junctions? The opposite sides are thus metallic and dielectric. The metal-air force is of the order volts; the metal-metal force is of the order millivolts. When a piece of zinc is put in contact with a piece of copper, the oxygen atoms which surround these bodies move slightly away from the copper and approach slightly nearer to the zinc. These slight motions produce the whole Volta effect. All that is necessary for the Volta effect is the inherent film on the surface; all the rest of the gas is mere dielectric, and might be substituted by a vacuum. The safest and clearest mode of expressing the Volta effect is that it consists in an opposite charge acquired by dry zinc and copper while in metallic contact—a charge which results from an E.M.F. of fixed value and is controlled solely by this E.M.F. and electrostatic capacity.

FLUORESCENT SCREENS. — When Röntgen-ray observations are made by means of fluorescent screens, a certain short time is found to elapse before the X-ray picture is built up. The bones of the hand, for instance, are not visible at once on the screen; they gradually separate out from the flesh. This effect is only partially due to a change in the radiation impinging upon the screen. What is known as a "hard" X-ray vacuum tube produces radiographs with greater contrast than "soft" tubes do, and the above effect might be put down to the hardening of the tubes while in action. On the other hand, however, a gradual and distinct brightening of the screen is observed, which is quite independent of any change in the radiation and is unaccompanied by any observable change of colour or chemical constitution. Some experiments made in this direction recently by Precht show that the time required for a good development of the radioscopic picture is on the whole shortest at the highest discharge potentials. It varies from a few seconds to a minute. A feasible explanation of this phenomenon lies in an allotropic modification of the substance of the screen, as supported by Becquerel for radium rays. Precht, however, puts forward an emission hypothesis for Röntgen rays.

PROFESSOR D. E. HUGHES.—At a recent meeting of the French Academy of Sciences it was announced that the late Professor Hughes had bequeathed to that institution a sum of £4,000, the income of which is to be used as a prize for the most important discovery in Physical Science, preference being given to a discovery in electricity or magnetism. A similar announcement was made by the President at a meeting of the Institution of Electrical Engineers a few weeks ago, to the effect that Professor Hughes had bequeathed the sum of £2,000 for the foundation of a "David Hughes Scholarship" in connection with the Institution.

ELECTRIC FISH OF THE NILE.—Under this heading a note appeared in the "Physics" column of SCIENCE-GOSSIP for May 1899, p. 372, when particulars were given of Professor Gotch's lecture delivered at the Royal Institution on March 17th of that year. Professor Gotch's hypothesis was that the seat of the electromotive force in the fish known as the *Malapterurus electricus* lies in the nerve centre itself, and not in the so-called electric organ. Some recent experiments by Professor Gotch and Mr. G. J. Burch point still more conclusively to this hypothesis being the correct one. One of Mr. Burch's capillary electrometers was used for measuring the values of the electromotive force. The fish experimented upon was first anaesthetised and then killed, and a strip of the electric organ with the nerve was carefully dissected out and kept at a temperature of 5° C. The time-lag between the excitation of the nerve and the record of an E.M.F. was then observed. From the various results obtained, the authors think it probable that the greater part of the time was occupied by the slow transmission of the excitatory state along the finest subdivision of the nerve within the organ near the ultimate ends. In dissecting the anaesthetised animal Professor Gotch received a strong shock while dividing a nerve-branch with metal scissors, the organ being grasped with metal forceps. After a comparatively few successful experiments the excitability of the nerve suddenly failed, and this was attended by inability of the organ to respond, whether a stimulus was applied to the nerve or to the organ substance. Measurements of the resistance of the organ were made, and it was found by taking readings longitudinally to the column and transversely, *i.e.* across and parallel to the "discs" respectively, that the resistance of the thin "discs" was considerably higher than that of the albuminous composition between them. If Professor Gotch's theory is the correct one, then what is the function of the so-called electric organ? May it not combine the duties of condenser and connection board? It may be for this reason that the "discs" are formed thin and are of high resistance to serve as dielectrics between the conducting albuminous fluid in the compartment spaces.

SEARCHLIGHTS.—A new portable electric searchlight is reported to have been recently added to the equipment of the New York fire brigade, for use at night fires or where the smoke is very dense. The lamp takes 35 ampères of current, and will emit a light of about 6,000 candle-power.

GEOLOGY

CONDUCTED BY EDWARD A. MARTIN, F.G.S.

Geological Society of London.—On the retirement of Mr. W. Whitaker, B.A., F.R.S., from the Presidency of the Geological Society of London after his two years' term of office, Mr. J. J. H. Teall, M.A., F.R.S., was, at the annual meeting on February 16th, elected to fill the office.

Women as Fellows.—The question of admitting to Fellowship of the Geological Society of London those geologists who are at present disqualified by reason of their sex was discussed at the anniversary meeting on February 16th last. The subject was brought up on account of the resignation from the Council of Dr. G. J. Hinde, F.R.S., as a protest against the refusal of the Council to invite a lady to attend in person to receive a medal which had been awarded to her by the Society. So far as the Fellows present were concerned, there seemed to be a large majority in favour of women Fellows. The subject was by mutual consent withdrawn, after being discussed by Dr. Woodward and Prof. Hughes; it being understood that the Council would further consider the matter. Dr. Woodward incidentally mentioned that forty years ago Mrs. Horner and Lady Lyell were constant visitors to the Society's meetings.

Water-line in Chalk.—In discussing the water-supply of Yorkshire, in a recent lecture before the Hull Naturalists' Club, Mr. J. R. Mortimer states that the water-line in the chalk in no place exceeds a maximum depth of 300 feet, and makes the interesting observation that the water-line is not a horizontal plane, but rises northwards and westwards, somewhat resembling the contour of the chalk itself. Mr. H. P. Slade also found in Berkshire that the water-line has a strong tendency to follow the contour of the chalk. No explanation of this appears to have been suggested. It would be interesting to know if at other places a similarity has been noticed.

Point of Origin of Earthquake Shocks.—In a recent discussion at a meeting of the Geological Society of London the correctness of Mallet's theory, that the point of origin of an earthquake shock may be determined by the angles at which consequent cracks in buildings appear and at which chimneys are tilted out of the perpendicular, was questioned by Professor Milne, who aptly asked what ground there was for thinking that such cracks would always appear at right angles to the direction taken by the shock. So far as he could see, it was a theory unsupported by facts. Professor Sollas pointed out that, owing to refraction caused by a shock passing from hard rocks into superficial rocks of a less dense character, a considerable degree of refraction of the line taken by the shock might ensue. Consequently, the point of origin of the earthquake might really be at a far less depth than would be supposed.

Colouring of Geological Maps.—Many geologists have felt the necessity of adopting a uniform colouring for the maps which they prepare, and will gladly welcome the latest suggestion, which indeed has been carried into execution, of adopting the prismatic colours in successive order. In such a hypsometric map the violet end of the spectrum is used for the older rocks, the newer formations being coloured in succession with tints approaching the red end of the spectrum. The effect of such a map is very striking, and we recommend a trial of the system in making geological maps.

Malvern and Abberley Hills.—Professor Groom has been continuing his studies "On the Geological Structure of Portions of the Malvern and Abberley Hills," and has communicated his observations to the Geological Society. In his paper he gave descriptions of the exposed rocks of the Malvern Range from Swinyard Hill to North Hill, the district of Cowleigh Park, Martley, Woodbury, Wallsgrove, and the neighbouring tract of Coal Measures. The Silurian rocks west of the hills are almost invariably inverted, and the Malvernian rock frequently can be found to be overthrust on to them. In several cases there is reason to suspect that slips of Silurian rocks are caught in infolds amongst the Malvernian rocks. The author concludes that the whole of this district, May Hill, the Old Red Sandstone tract to the west, the coalfields of the Forest of Dean, S. Wales, and Bristol, and the Tortworth district, are traversed by a series of related folds, whose axes run in two chief directions intersecting at a considerable angle: the axial planes of one set tend to dip east, and of the other in a southerly direction. Overfolding has taken place frequently from the east, less frequently from the south; and this inversion affects the southern as well as the middle and north of the Malvern range. The Archaean rocks are thrust into various members of the Carverian System in the south and of the Silurian System in the north. The intensity of the folding diminished west of the old ranges. The chief movement appears to have progressed in sections from north to south, and the western fronts of different sections show some tendency towards convexity in the direction of movement.

Colouring Matter of Fluorspar and Calcite.—The question as to whether the beautiful coloration which these minerals sometimes exhibit is of organic or inorganic origin has been much discussed. In a paper in the annual report for 1897 of the Naturalists' Society of Brunswick, Herr Frome publishes the results of some chemical experiments undertaken with the view of settling the matter. Analysing a specimen of chestnut-brown translucent calcite, he found that it contained no iron or manganese or other inorganic substance calculated to impart the dark colour. The mineral completely dissolved in HCl with a wine-yellow colour and separation of brown flocks. The latter was found to be identical with Berzelius's apocrenic acid. The amount of this was about 0·2 per cent., and 0·01 per cent. of another blackish acid was also obtained from the yellow filtrate. Herr Frome concludes that these acids exist in combination in the calcite, and from an ammoniacal solution of apocrenic acid containing some bicarbonate of calcium he obtained artificial crystals of brownish calcite exactly similar to those of the natural mineral. I may add that the apocrenic acid aforesaid is commonly found as a constituent of vegetable mould and humus matters, and is doubtless of organic origin. It results from the decomposition of the benzene derivatives contained in decaying leaves and rootlets, and perhaps some of the cellulosic-proteid combinations of the plant may also contribute to its production.—*Dr. P. Q. Keegan, Patterdale, Westmoreland.*

CORRESPONDENCE.

WE have pleasure in inviting any readers who desire to raise discussions on scientific subjects, to address their letters to the Editor, at 110 Strand, London, W.C. Our only restriction will be, in case the correspondence exceeds the bounds of courtesy; which we trust is a matter of great improbability. These letters may be anonymous. In that case they must be accompanied by the full name and address of the writer, not for publication, but as an earnest of good faith. The Editor does not hold himself responsible for the opinions of the correspondents.—*Ed. S.-G.*

OBSERVATIONS ON VARIABLE STARS.

To the Editor of SCIENCE-GOSSIP.

SIR,—It has occurred to me that the fullest advantage has not been taken of all the data which observation of variable stars has given to us. I propose to show, taking the well-known variable Algol as an example, that several more interesting facts may be determined. The following is a summary of what we already know about this star. Algol and his satellite revolve in circular or approximately circular orbits, for the variations of speed indicated by the spectroscope are precisely those which would be shown by a body revolving at a uniform rate; these orbits are of course in the same plane. The line of sight from the earth to Algol also lies in this plane, for Professor Pickering has found that the method of diminution of light during eclipse is exactly such as would be caused by a spherical body passing in front of Algol. The eclipse is therefore annular, not partial, and the conclusion just given follows at once. The complete period of revolution of either Algol or his satellite is very approximately 4,089 minutes, that of greatest eclipse is 20 m., and the total period of eclipse is 560 m. Algol varies from the second magnitude at maximum to the fourth at minimum; *i.e.* at the time of greatest eclipse we receive from it $\frac{1}{(2\cdot512)^2}$ of the light we receive normally. Now it follows from the "law of inverse squares" that when an opaque sphere passes in front of a large luminous one, that S_1 being surface of luminous sphere, S_2 that of opaque one, D_1 distance of former, D_2 that of latter, L_1 light of former uneclipsed, L_2 when at greatest eclipse, then

$$\frac{S_1}{S_2} = \frac{L_1 D_1^2}{(L_1 - L_2) \cdot D_2^2}.$$

∴ if A and B represent the diameters of Algol and his satellite respectively

$$\frac{A}{B} = \frac{\sqrt{L_1}}{\sqrt{L_1 - L_2}} \cdot \frac{D_1}{D_2} = \frac{\sqrt{L_1 (L_1 - L_2)}}{L_1 - L_2} \cdot \frac{D_1}{D_2}.$$

But the difference between the distances of Algol and his satellite is so minute, compared with that of either from the earth, that the ratio of D_1 to D_2 may, without any appreciable error, be taken equal to unity.

$$\therefore \frac{A}{B} = \frac{\sqrt{L_1(L_1 - L_2)}}{L_1 - L_2}.$$

Taking $L_1 : L_2 = (2\cdot512)^2$, this gives that, corrected to six places of decimals, the diameter of Algol is 1·090100 times that of his satellite. There is, however, another entirely different method of finding this ratio which I will now explain. A little consideration will show that the distance across the "line of sight" from the Earth to Algol which he and his satellite traverse during the total period of eclipse is A + B, and similarly that passed over during the 20 m. of greatest eclipse is A − B; also, since they are moving uniformly in similar orbits, the distances which either separately passes over in these two periods are in the ratio of A + B to A − B. The distance across the line of sight which either of them traverses during one of these periods is the chord of its orbit on which stands the arc described during the time. For, taking the mean line of sight to be that from the earth to Algol at exactly the middle of the eclipse, the arc described by either the latter or his companion during eclipse is symmetrical with regard to this line, and therefore the chord on which it stands is perpendicular to it. Let the chord described by either Algol or his satellite (it makes no difference which we take) during the whole eclipse be C_1, during time of maximum eclipse C_2. Let the angles subtended at the centre of motion by these chords be θ_1 and θ_2 respectively.

Then $C_1 : C_2 :: \sin\theta_1 : \sin\theta_2$. But θ_1 in degrees is

$$\frac{360^\circ \times \text{arc described during eclipse}}{\text{circumference of orbit}}$$

$$= \frac{360^\circ \times \text{period of eclipse}}{\text{period of revolution}} = \frac{360^\circ \times 560}{4089} = 49^\circ\ 18\cdot9'.$$

$$\text{Similarly } \theta_2 = \frac{360^\circ \times 20}{4089} = 1^\circ\ 45\cdot65'.$$

$$\therefore \frac{A+B}{A-B} = \frac{C_1}{C_2} = \frac{\sin\theta_1}{\sin\theta_2} = \frac{\sin 49^\circ\ 18\cdot9'}{\sin 1^\circ\ 45\cdot65'} = \frac{7583}{308}$$

$$\therefore \frac{A}{B} = 1\cdot084674 \text{ corrected to six places of decimals.}$$

This result agrees very well with that arrived at by the previous perfectly independent process. It will be seen that the whole difference is only ·005426, which, if Algol's diameter was 1,000,000 miles, or considerably greater than that of our sun, would only make the comparatively very small difference of 4,681 miles in estimating that of his satellite. If the line of sight was slightly tilted out of the plane of Algol's orbit, not sufficient to make the eclipse partial, but causing it to be unsymmetrically annular as seen from the earth, the distances across the line of sight passed over during the whole eclipse and maximum eclipse would then be less than A + B and A − B; consequently the result arrived at by the second method would be rather too large. Since, however, the latter is actually slightly the smaller of the two, what difference there is cannot be accounted for in this manner, and hence the orbit is not tilted. Thus we reach the rather important conclusion that Algol's orbital velocity, as shown by the spectroscope, of 26·5 miles per second, is his true velocity; for if the orbit was tilted the latter would have a component perpendicular to the line of sight which would not affect the spectroscope. I think the small discrepancy can be best accounted for by the very likely supposition that the true variation during eclipse is not really precisely two theoretical magnitudes; or, again, the orbits may not be *exactly* circular.

If the fluctuations in light of a large number of variable stars were compared with their periods of eclipse in the above manner, some interesting results might be obtained. When the two results were approximately equal, we should know that the star in question revolved in a circular orbit in a common plane with the line of sight. When they were greatly different, it would show that either the orbit

was elliptical or very much tilted. By examining the light with the photometer, so as to see if the variation was such as would be produced by a dark sphere, we could determine which of these two hypotheses was correct. Some stars would need exceptional methods of examination; for instance, δ Cephei, which is much longer passing from maximum to minimum than *vice versâ*. This would be explained if the star revolved in an elliptical orbit whose minor axis was parallel, or nearly parallel, to the line of sight, the focus round which it and its satellite revolved being the one which the former approached nearest to in the half period after eclipse. It would thus describe this part of its orbit more rapidly than the other. Again, β Lyrae with a double period has probably two satellites of unequal size, which would account for the fact that, though the maxima of this star are equal, the minima are unequal.

R. J. HUGHES.

Norman Court, Southsea:
Feb. 16th, 1900.

EDITORIAL NOTICE.

I have to sincerely thank the very large number of our readers who have so kindly inquired, and expressed their sympathy, during my past serious illness. It was occasioned by an acute attack of pneumonia, resulting from a chill on December 14th last. The consequent after-effects so frequently attending a seizure of this kind are rapidly passing away.

I have to thank my colleague, Miss Flora Winstone, for having, unaided, conducted the editorial duties of SCIENCE-GOSSIP numbers for January, February, and March. I greatly regret, however, to have to say that this lady has had to undergo a severe surgical operation, entailing the removal of a portion of the skull. I am happy to report that it was successfully accomplished, and she is progressing towards recovery.

JOHN T. CARRINGTON,
Editor SCIENCE-GOSSIP.

NOTICES OF SOCIETIES.

*Ordinary meetings are marked †, excursions *; names of persons following excursions are of Conductors. § Lantern Illustrations.*

ROYAL INSTITUTION OF GREAT BRITAIN.
April 3.—†Fishes. Professor E. Ray Lankester, F.R.S.
,, 5.—†Highest Andes. E. A. Fitzgerald, F.L.S.
,, 6.—†Solid Hydrogen. Professor Dewar, F.R.S.
,, 7.—†Polarised Light. Lord Rayleigh, F.R.S.

SOUTH LONDON ENTOMOLOGICAL AND NATURAL HISTORY SOCIETY.
April 12.—†Paper by J. W. Tutt, F.E.S.
,, 26.—†§Wild Flowers at Home. E. Step, F.L.S.
,, 26.—†§Ornithology.

NORTH LONDON NATURAL HISTORY SOCIETY.
April 5.—†Some Birds of Norfolk Broads P. J. Hanson.
,, 19.—†Fruits and Seeds on their Travels. H. W. S. Worsley-Berrison, F.L.S.
,, 28.—*Visit Mammals Section B.M. J. A. Simes.

LAMBETH FIELD CLUB AND SCIENTIFIC SOCIETY.
April 2.—†How the Earth is Weighed and Measured. J. J. Hall, F.R.A.S.
,, 7.—*Visit Odontological Society's Museum, Leicester Square, W.C.
,, 16.—*Bookham and Ranmore. G. Masters.
,, 28.—*Kew Gardens. E. J. Davies.

CROYDON AND NORWOOD BRANCH SELBORNE SOCIETY.
April 5.—†Mosses of Croydon District. H. G. Bradley.
,, 20.—†Annual Meeting.

THE SIDCUP LITERARY AND SCIENTIFIC SOCIETY.
April 3.—Sound, Light, and Heat. Rev. D. Ross, B.Sc.
May 1.—†Microscopical and Wild Flower Evening. Messrs. Hembry and Tappolet.

HAMPSTEAD ASTRONOMICAL AND SCIENTIFIC SOCIETY.
April 6.—†Paper. Frederick Womack, M.B., B.Sc.
May 4.—†Hypnotism. A. E. Tebb, M.D., B.S., D.P.H.

NOTICE.

SUBSCRIPTIONS (6s. 6*d.* per annum) may be paid at any time. The postage of SCIENCE-GOSSIP is really one penny, but only half that rate is charged to subscribers.

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EDITORIAL COMMUNICATIONS, articles, books for review, instruments for notice, specimens for identification, &c., to be addressed to JOHN T. CARRINGTON, 110 Strand, London, W.C.

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NOTICE.—Contributors are requested to strictly observe the following rules. All contributions must be *clearly* written on one side of the paper only. Words intended to be printed in *italics* should be marked under with a single line. Generic names must be given in full, excepting where used immediately before. Capitals may only be used for generic, and not specific names. Scientific names and names of places to be written in round hand.

THE Editor will be pleased to answer questions and name specimens through the Correspondence column of the magazine. Specimens, in good condition, of not more than three species to be sent at one time, *carriage paid*. Duplicates only to be sent, which will not be returned. The specimens must have identifying numbers attached, together with locality, date, and particulars of capture.

THE Editor is not responsible for unused MSS., neither can he undertake to return them unless accompanied with stamps for return postage.

ANSWERS TO CORRESPONDENTS.

O. H. E. (Walton-on-Thames).—The vivid green colour sometimes found on decaying wood is, we believe, caused by some species of bacteria. It is certainly not chlorophyll. Several kinds of bacteria produce brilliant colours in the substance occupied by them.

EXCHANGES.

NOTICE.—Exchanges extending to thirty words (including name and address) admitted free, but additional words must be prepaid at the rate of threepence for every seven words or less.

FOSSILS. Ordovician, Silurian, Devonian, Rhaetic, and Jurassic, will exchange for Chalk, Thanet, Woolwich, Oldhaven, London Clay, Crag or Drift species.—Dr. Brendon Gubbin, 15 Redland Grove, Bristol.

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